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THE APPOINTMENT AND TENURE OF UNIVERSITY PROFESSORS[1]

THE subject, appointment and tenure of university professors, divides itself naturally into two parts. With the question of appointment will be considered also that of promotion. The statements of fact given below are confined to the twenty-two universities which belong to this association, viz.: California, Catholic, Chicago, Clark, Columbia, Cornell, Harvard, Hopkins, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, Pennsylvania, Princeton, Stanford, Virginia, Wisconsin and Yale.

FACTS AS TO APPOINTMENTS AND PROMOTIONS

The appointment and promotion of members to professorial rank, with the exception of associate professors at Catholic University, rest with the governing board. Instructors and men of lower ranks are at some institutions appointed by the senate, faculty or president. Thus at Columbia they are appointed by the faculty subject to confirmation by the board, and such confirmation is purely formal. The governing boards have different names in different institutions. In the endowed institutions the boards are usually called trustees; in the state universities, regents; but neither of these rules is invariable. At Harvard and Yale the governing boards are called corporations; at Missouri the governing board is one of curators; at Iowa a board

[1] Address delivered at the meeting of the Association of American Universities at the University of Virginia, Charlottesville, November 10–11, 1910.

of education; at Virginia the rector and visitors.

The important point with reference to appointments and promotions is not as to the nature of the organization which makes the appointment, but as to the representatives that make the recommendations to the board; for in most cases as long as these representatives have the confidence of their board, an appointment or promotion when recommended is made. The functions of the board in this matter are primarily financial. The creation of a chair rests to a large extent with the board; since whether or not it can be supported depends upon financial considerations. If the recommendations made can be financed, they are likely to be accepted; but if not they may be rejected on this ground. Also on other grounds a board may exercise its veto power. But almost without exception the boards do not regard it as their function to take the initiative in appointments and promotions. Such initiative they place with the educational officers.

Occasionally the members of a board of trustees have dealt directly in the appointment of members of the instructional force. This is true at the present time to some extent in one of the institutions of the twenty-two, but this situation is exceptional and even in this institution probably temporary. Almost without exception, when an appointment has been authorized by the board, the recommendation of the president or some other representative or representatives of the faculty is decisive.

In seventeen of the twenty-two institutions of this association the recommendations as to appointments, promotions, and removals rest with the president, chancellor or provost of the institution. In this paper the term president will be used to comprise all three. Of these seventeen institutions, in three the recommendations can be made only after the concurrence of or consultation with other academic officers. These are as follows:

At Kansas the recommendations go to the governing board through the chancellor, but such recommendations must come jointly from him, the dean, and head of the department concerned, the chancellor having the veto power if he wishes.

At Cornell the "statutes require that the president shall consult with the heads of departments before making nominations in these departments."

At Stanford appointments and promotions, with reference to which the president has the initiative, must be submitted to an advisory board consisting of nine members of the rank of professor, and when the president submits his recommendations he must state whether or not they have the approval of the advisory board.

A part of the advisory board is elected from specified groups of departments and others are elected at large, all elections being without nominations by secret ballot of the academic council. The term of office is three years, and one third go out of office each year. Every nomination, promotion or removal of the instructional force, large or small, goes before this board. In connection with this matter it is to be said that Stanford has no deans, the president dealing with reference to each department through its executive head, who is annually appointed by the president with the approval of the advisory board.

The five institutions in which the recommendations to the board are not made by the president are as follows:

At the Catholic University of America appointments of professors are made by the board of trustees "after consultation with the academic senate and with the faculty of the school comprising the depart-

ment to which the appointment is to be made." Associate professors "may be appointed by the academic senate, after consultation with the faculty of the school to which the appointment is to be made." The academic senate consists of the rector as president, the vice rector, the general secretary, the presidents of the university colleges, the deans of the faculties and two professors from each faculty.

At Johns Hopkins appointments are made by the board upon the recommendation of the academic council. This council consists of the president and ten professors.

At Minnesota appointments are made upon the recommendation of the dean of the college concerned after consultation with the president. In this case the usual positions of the dean and president are reversed.

At Pennsylvania the faculties of the several schools make recommendations for appointment and promotion to the trustees and provost. In case the provost does not concur in a recommendation, he retains the right of veto; but as a matter of fact has in no case exercised it.

At Yale "nominations for positions in the faculty of any existing department except the graduate school shall come originally from the permanent officers or governing board of that department." The term department, as here used, is equivalent to school or college. The faculty of the school or college acts upon the recommendation of a committee of five professors appointed by the dean, two at least of which are from departments of study outside of the vacant professorship. This committee after conference with the president and dean presents its recommendations to the faculty of the school or college. The recommendation of the school or college is transmitted to the corporation. In the graduate school the nominating committee is appointed by the president rather than the dean.

Also at Harvard in the medical school the recommendations are made to the governing board by the full professors instead of by the president.

The procedure at Columbia is somewhat exceptional in the matter of appointments, in that recommendations to the trustees for men of professorial rank are by their own board of education. Since, however, the president presents the names and records of the persons proposed with his expression of opinion concerning them, the result is the same as if he made formal recommendation to the board; and therefore Columbia is included in this class of institutions.

In the case of the academic senate of the Catholic University, the academic council of Hopkins, the faculty of Yale, the president is a member; and at Yale he must be consulted by the faculty nominating committee; not only so, but "no decision of the faculty shall be valid which does not receive the concurrence of the president unless it shall be discussed and approved by the corporation."

Therefore it is clear that even in these five cases the president has much influence in the matter of appointments, etc. Since the president makes the recommendations to the governing board as to appointments, promotions and removals in the case of seventeen institutions and his recommendations are usually accepted, the point of paramount importance in connection with appointments and promotions is as to the manner in which the president exercises his authority. As we have already seen, in three institutions, the president is required to advise with a definite body of officers before acting. In one case the president has a definitely announced plan of taking

advice before making a nomination. Thus, in California, the president has "at his own option and by his own suggestion, called together a committee consisting of professors of five nearest related departments for conference as to the nomination of any one professor. The nomination of assistant professors and instructors is made by the president after conference with the departments concerned."

In the great majority of cases, fourteen in number, so far as I have been able to ascertain, the president makes his recommendations without any definitely announced plan of conference but with a very definite method of securing advice.

1. Usually where the university is organized into schools and colleges with deans or directors, the nominations of all officers in a school or college are made after close consultation with and the concurrence of the dean or director. Indeed, in many institutions the dean or director is expected to take the initiative in going over the ground and getting the material ready to present to the president. This is especially likely to be true of the professional schools, but in some institutions is true of all schools and colleges.

2. The president frequently, and in the case of some institutions usually, consults directly with the professor serving as the executive head of the department, and he may also consult with other professors of the department. This is especially likely to be true of the college of liberal arts or a college of arts and sciences, as, for instance, at Harvard and Michigan. In this case the duties of the deans mainly concern the students. This situation is historical, in former years the president of the modern university having had as his main or sole function the presidency of the college of liberal arts.

In consequence of this situation, in many institutions, the relation of the president to the departments of the college or colleges of arts and sciences is more intimate than with reference to the departments of other colleges.

3. The president may consult with both the deans and the professors of the department concerned; and not infrequently he may consult with the professors of allied departments.

I think it may be said that in general the president in the exercise of his authority of nomination takes advantage of all available sources of information. Any president who acted independently would probably have a brief tenure of office. In short, it is the general rule for the president before making a recommendation to have the concurrence of the professors of the department concerned, the dean or director of the school or college interested, and frequently the professors of allied departments.

Nevertheless, it does not follow that the president always follows the recommendations received. While he would not nominate a man contrary to the wishes of interested officers, he may decline to make a nomination or promotion of a man recommended by a department. In other words, he exercises the veto power. In some cases the president instead of exercising the veto power transmits the recommendations of the department with the information that he does not concur in them. The result is the same. The presidents of this association report that under such circumstances the governing boards hold the president responsible and invariably refuse to make an appointment which has not his concurrence. While the president must necessarily depend upon the sources of information mentioned with reference to professional attainment, another important factor in the success of a professor

and his fitness for work in an institution is the personality of the man in reference to energy, adaptability and other general qualities. Concerning these points the president has a right to a judgment. If a man does not in his opinion come up to the standards which he holds he may decline to make a nomination or recommendation for promotion urged by a department.

Finally, after a department is once established, very exceptionally the president might take the initiative in the nomination of a man of professorial rank. Such an action could only be justifiable in case the president does not have confidence in the department as it exists. This situation is more likely to occur in institutions that are trying to raise their faculties to a higher standard, for instance from that of a college to a university basis, than in those institutions the departments of which are well established and on a somewhat permanent basis.

The extent to which the president personally participates in the councils leading to the nomination of a man depends largely upon the proposed rank of the man. His participation is usually more intimate with reference to the nomination of men whose appointments are indeterminate—professors and associate professors; he is perhaps more likely to accept the judgment of others without close personal investigation in the case of the assistant professor who is appointed for a definite term, and a mistake in reference to which is not so serious a matter. He usually accepts without question the recommendation of the department or a dean for instructors and lower ranks.

THE POWER OF THE PRESIDENT.

It is clear from the above statement of facts that the president of the university for the great majority of the institutions of this association occupies a very important place in the building up of the staff. The question therefore arises as to whether his authority should be curtailed. During the past half dozen years a number of papers[2] have appeared which have strongly urged this, not only with reference to appointment and removal, but in other directions. The writers of some of these have gone so far as to state that the office of president should be abolished.

With reference to the particular point under discussion—the appointment and promotion of the instructional staff—the only substitute for the exercise of the nominating power by the president which has come to my notice is that the faculty shall elect and dismiss the professors, this being subject merely to the veto of the trustees. This proposal goes farther than is the practise of the Prussian universities. There, the faculty nominates three members for a vacant professorship, from among whom the minister of education selects one; but in one case out of three during the last seventy years, according to President Pritchett,[3] the minister has gone altogether outside of this list. The reason assigned for so doing was that the faculties are likely to be influenced by "personal considerations in their choice, not by considerations of the highest usefulness of the man to be chosen." The implication that if in America the office of president were abolished and his duties assigned to the faculty, the situation would be similar to

[2] This class of papers is illustrated by: "Closer Relations between Faculties and Trustees," James P. Munro, *Science*, Vol. 22, 1905, pp. 848–855; "Externalism in American Universities," George M. Stratton, *Atlantic Monthly*, Vol. 100, 1907, pp. 512–519; "Academic Control," J. McKeen Cattell, SCIENCE, March 25, 1906; "Academic Aspects of Administration," Joseph Jastrow, *Popular Science Monthly*, Vol. LXXIII., October, 1908, pp. 326–339.

[3] Henry S. Pritchett, *Atlantic Monthly*, Vol. 96, p. 296.

that of Germany, is erroneous; since in Germany the minister of education to a large extent performs the functions that the president does in America. Indeed, with reference to the appointment of professors it is clear that the power of the minister in Germany is quite as great as that of the president in America.

The proposal to have the faculties make nominations of professors has a certain plausibility, and, as we have seen, is practised in four institutions, but the plan has not generally appealed to the governing boards, nor do I think it probable that it will in the future.

The fatal defect in the administration of a university by the faculty rather than by the educational executive officers is its extravagance. When an educational institution was small the faculty could do its administrative work. But in large universities, in the consideration of educational policies, which are agreed should belong to the faculty, progress can only be made by sending a matter first to a faculty committee. The committee spends much time in whipping the matter into shape. It then goes to the appropriate faculty. After consideration more or less prolonged, if favorably acted upon, it goes to a university faculty, academic senate, or academic council. This body in turn goes over the subject and finally acts. It must be admitted that this procedure is extremely expensive.

While expensive, I am not arguing for a change. University unity is more important than administrative efficiency; and in order to secure harmony in a university it is necessary that the faculty exercise authority with reference to educational policies. While costly, it will be necessary to leave educational policies in the hands of the faculty.

If all the questions of administration, including that of appointment, were to be handled by the faculty acting either as a committee of the whole or through its committees which in turn report to the faculty, the faculty would have much less time to devote to their main duties—instruction and investigation. This would be the result of "increasing the legislative and administrative responsibility of the faculty" as proposed by Munro.[4]

At this point there is a curious inconsistency in the position of many members of the faculty. At the very same time that they are complaining of the extent of authority of the executive officers they are also complaining of the amount of committee work which is required of them. They state that even with the situation as it is so much committee work is required that they are unable to do satisfactorily their own work.

These and other considerations have resulted in a tendency not in the direction of curtailing the power of the president in reference to appointment, but, on the contrary, for the governing boards to place that power in his hands and hold him responsible. This is illustrated by Virginia, an institution which, after having lived nearly one hundred years without a president, has created that office; and the University of Toronto which was even more recently reorganized along American lines with a president having practically the same powers as in the United States.

The only constructive suggestion which I have seen in reference to the president is to have the professors, rather than the governing boards, elect him and determine his powers.[5] While it is not probable that the

[4] "Closer Relations between Faculties and Trustees," James P. Munro, SCIENCE, Vol. 22, 1905, pp. 848–855.

[5] George M. Stratton, "Externalism in American Universities," *Atlantic Monthly*, Vol. 100, 1907, pp. 512–519.

governing boards will consider this proposal, if it were adopted, I suspect it would turn out that in order to secure efficiency of administration the president would exercise substantially the same powers that he now does; and this would be the case whether or not it was originally so planned. If an educational executive officer is essential, then he must have the powers which are necessary to give efficiency, and as a result of evolution these powers would probably not very greatly differ whether the officer were elected by the faculty or by the trustees. Whether the faculties would choose presidents more wisely than the trustees may well be doubted; and the exercise of the function would be very likely to introduce factional strife which might endanger the usefulness of the man selected.

In reference to the particular point under discussion—the appointment, promotion and removal of professors—it can not, I think, be charged that the president does not fully realize the seriousness of his responsibility; indeed, of all of his functions that of nomination to the faculty is the one through which he is able to make the largest impression upon the development of an institution. If he is sufficiently wise in using the information and recommendations of the deans and other officers as to be successful in this and a faculty of high grade is built up, the reputation and influence of the university will be a rising one.

It appears probable that if there is any formal development in the near future in reference to appointment, it will not be in the direction of taking away the nominating power from the president, but toward having the president exercise the power reposed in him, after consultation or concurrence with some other academic body, as in the case of the council at Hopkins and the advisory board at Stanford. In this connection the question arises as to whether or not it would be better for the more numerous institutions in which the president exercises this power without any regulation, but under well defined principles, to formulate them into rules. Upon this point there doubtless will be great difference of opinion.

If future development goes in the direction of formulating rules for the advice of the president in the exercise of his power of nomination, it seems to me that it would be advantageous for them to be along the lines of providing a changing body for each case. The great strength of this plan would be that the president would continue to consult all the interested parties; whereas, an academic council may be largely composed of men who do not know the facts at first hand. This point is illustrated by the self-imposed rule of the president of the University of California, who, when considering the appointment of a man of professorial rank, calls together a committee of the professors of the five nearest related departments for conference. But this very case illustrates the difficulty of the formulation of the principles of advice into rules. In some instances it might not be advisable to consult with so many departments as five, and in other cases more than that number.

Considering the whole situation, I think it would be well to announce as a fixed practise, where this is not already understood, that the president in the exercise of his authority of recommendation to the governing board as to appointments, promotions and removals, should do so only after consulting the executive officers of the school or college concerned, and in cases where he regarded it as advisable, the members of the department concerned, with the recognized right of consultation

upon the part of the members of such departments. If this were done, the faculty, the governing board and the public would know that the president in the exercise of his powers of recommendation has had the advice of some responsible academic body, and the cry of "czardom," "tyranny," "the powers of academic life and death," in reference to the president, which in most cases is wholly without foundation, would be lessened.

THE FACTS AS TO TENURE OF APPOINTMENT

In general, the appointments of professors are "during good behavior," or "at the pleasure of the board." In some institutions the appointments are of indefinite tenure, or permanent. In all cases the meaning is the same, that the appointment is one for life to the age of retirement, provided the appointee is efficient.

The only variations from the above are as follows: At the Catholic University, professors may be appointed for an indefinite period, for a specified time, on probation, or to serve a temporary purpose. At Clark professors are appointed first for a term of five years and if reappointed "at the pleasure of the board." At Columbia appointments to professorial rank are for three years, or at the pleasure of the board. Other institutions make occasional appointments for a definite term.

In general, the terms of appointment of associate professors are the same as for professors. (Here are included the junior professors of Michigan.) The exceptions are as follows: At Hopkins the associate professor for the first five years has an annual appointment, and thereafter on the professorial basis. At Stanford associate professors are appointed for five years. Some institutions do not have the rank of associate professor.

Assistant professors are usually appointed for a definite period, often for three years, but sometimes a shorter or longer period. The institutions varying from the three-year term are as follows: California, one year; Catholic, period either indefinite or determinate; Chicago, four years; Columbia, one year (called junior professors); Cornell, five years; Harvard, five years; Hopkins (associates), one year; Kansas, annual for two years, thereafter permanent; Illinois, permanent; Iowa, permanent; Indiana, permanent; Minnesota, indefinite; Missouri, indefinite; Nebraska, permanent; Princeton, permanent; preceptors with the rank of assistant professor, for a specified term; Catholic and Hopkins do not have assistant professors.

It is notable that with the exception of Princeton the institutions which at once or almost immediately make the appointments of assistant professors for a permanent or indefinite tenure are a group of state universities in adjacent states—Indiana, Iowa, Illinois, Missouri, Kansas, Nebraska and Minnesota. For this geographic association I have no explanation to offer, but doubtless a sufficiently deep investigation would find one.

While not properly included in the scope of this paper, for the purposes of comparison the tenure of instructors is also given. For the most part instructors are appointed for a period of one year. The exceptions are as follows: Chicago, three years; Cornell, after one or more year's experience, two years; Harvard, annually, or for a term of three years; Indiana, permanent; Minnesota, indefinite; Nebraska, permanent; Virginia, usually indefinite, but subject to termination at the instance of either party; Yale, one or two years.

From the above statement of facts it appears that the practise of the institutions belonging to the Association of American

Universities with reference to tenure of appointment is well crystallized. Appointments of professors and associate professors are practically permanent. While in several institutions assistant professors are appointed for an undetermined or permanent term, commonly they are appointed for a definite term, and there is a strong tendency to make it three years. For instance, in some institutions where the appointment in the past has been for a longer period, five years, it has been changed to three years, as recently at Yale. In other cases where the appointment has been for a briefer term than three years, it has been extended to three years.

I am not aware of any criticism as to the above principles concerning tenure of appointment. They seem satisfactory alike to the trustees and to the faculty. In making the appointment of assistant professor for a period of years greater than one it is recognized that the man is far enough along so that the question need not be raised each year as to his fitness to continue; but also in the majority of institutions it is recognized that after having had a reasonable time in which to "make good" the question should come up without embarrassment to the authorities as to whether or not he shall be reappointed. Also at this time the question of his promotion naturally arises.

PROFESSORS SHOULD BE EFFICIENT

The question now arises as to what should be done in the case of a man of professorial rank, whether full, associate or assistant, who is not efficient. Not infrequently papers with reference to this subject appear to assume that universities exist for the instructional force; that the main thing is to give that force a comfortable and happy time, an opportunity for a somewhat easy existence as a teacher, leisure for browsing through literature, and long vacations. I shall not consider the merits of this hypothesis, but shall say merely that I adhere to the ancient view that universities do not exist for the instructional force nor even for the administrative officers, which include the president, but that they do exist for the students and for the public. This view I suspect governing boards as representatives of the public will continue to insist upon.

If this view be accepted, it follows that the instructional force of a university, both young and old, must be efficient. Whether or not a man is retained in a faculty should depend upon his capacity to meet his duty to the institution. There is no possible excuse for retaining in the staff of a university an inefficient man. In rapidly growing institutions, among the older men, it often happens that there are those who have worn out their lives in their service, and who have fallen behind the standard. In justice these men can not be requested to resign or be summarily dismissed. If in any institution there are such men, they should be pensioned. But the right of efficient instruction by the students should be respected. And certainly the young men on the staff of a university can claim no exemption from the principle that they are to be judged by the efficiency of their service to the students and to the public. This means that they must be good teachers or good scholars, or both.

Strongly contrasting with the above view is that presented by Lawton,[6] who says in reference to the professor: "His position should be as secure as one on the Supreme Bench, unless senile decay, permanent mental or physical disease, or fatal moral

[6] William C. Lawton, "The Decay of Academic Courage," *Edu. Rev.*, Vol. 32, p. 402.

lapse makes clearly obligatory his enforced (if not voluntary) retirement by a court composed largely of his associates.

And Stratton[7] says: "The faculty alone should normally have the power to dismiss its own members."

If the above views were accepted what chance would there be for a change in a chair occupied by an inefficient man? Can it be assumed even with any degree of plausibility that there would be one change per annum in the entire twenty-two institutions of this association?

Throughout history it has been the desire of the privileged classes to allow none but the members of the class itself to remove, reduce or punish its own members, and oftentimes these desires have been recognized. But in modern times for the majority of civilized nations, such privileges have been taken from the nobility; they are not likely to be instituted for the class of professors in America.

The responsibility of the governing board and the executive educational officers to the students and to the people is vastly greater than any obligation to the professor. The funds for the disbursement of which they are responsible are trust funds which to the best of their ability should be expended to accomplish the purpose for which the funds are available, and this is true whether the money comes from the public treasury or from private sources. If a professor does not efficiently perform his work he should not be continued. For a given institution, if care has been exercised in the building up of the faculty the cases requiring so drastic action as request for resignation or removal will be only occasional.

[7] George M. Stratton, "Externalism in American Universities," *Atlantic Monthly*, Vol. 100, 1907, pp. 512–519.

In the great majority of cases when the right of change is exercised because of the inefficiency of a professor, it has made no difficulty or comment; indeed, has rather strengthened the confidence of the faculty and the public in the governing body. For my own part, it appears clear that the ultimate authority to ask the resignation of or to remove a professor must rest with the governing body under the advice of the officer or officers who make recommendations as to appointments and promotions. The exercise of this authority should be clearly exceptional; but certainly it should be performed whenever a professor is clearly inefficient.

The only cases which have occasioned any serious discussion in reference to the tenure of professors have been those in which for some purpose, apparently not directly connected with the duties of a man or his good behavior, he has been dismissed. For such extremely exceptional cases I would propose no rule. Full responsibility must rest with the appointing authorities.

If they exercise the power of removal arbitrarily, the public will hold them sternly accountable, and their institution will suffer, because good men will not be so likely to go to a university in which the power of removal has been exercised in an indefensible manner, or exercised in a manner in reference to which there is any doubt. The public will always give the professor the benefit of the doubt.

In some cases where an institution has had a fairly good defense for the removal of a man, it has suffered for years in consequence of so doing. The punishment of the offending university by public condemnation is the most effective protection for the professor against arbitrary or unjustifiable removal.

Charles Richard Van Hise

SCIENTIFIC NOTES AND NEWS

DR. HENRY FAIRFIELD OSBORN, president of the American Museum of Natural History, was made curator emeritus of the department of vertebrate paleontology at the last meeting of the executive committee.

DR. SAMUEL G. DIXON, professor of hygiene in the University of Pennsylvania, and Dr. George Wharton Pepper, professor of law, have been elected trustees of the university.

DR. W. K. RÖNTGEN, professor of physics at Munich, and Dr. Ewald Hering, professor of physiology at Leipzig, have been appointed knights of the Prussian order pour le mérite. Dr. Gustav Retzius, formerly professor of anatomy at Stockholm, has been appointed a foreign knight of this order.

AN international committee has been formed to celebrate the jubilee of Professor Gaston Darboux's connection with university education, the work he has done for mathematics, and his services as permanent secretary of the Paris Academy of Sciences. It is proposed to present Professor Darboux with a medal, reproducing his portrait, together with an address signed by the subscribers.

ON February 8, a portrait of Professor W. Boyd Dawkins, F.R.S., will be publicly presented to the University of Manchester where he has been professor of geology.

PROFESSOR H. LORENTZ, of Leiden, has been elected a foreign member of the Paris Academy of Sciences to succeed Schiaparelli.

THE Chemical Society of France has elected, as we learn from *Nature,* the following foreign honorary members: A. v. Baeyer, Munich; Emil Fischer, Berlin; P. Guye, Geneva; L. Henry, Louvain, Belgium; C. Istrati, Bucharest; A. Lieben, Vienna; Louguinine, St. Petersburg; Raphael Meldola, London; Paternò, Rome; Sir Wm. Ramsay, London, and Ira Remsen, Baltimore. The late Professor S. Cannizaro had also been nominated by the council, but his death prevented his nomination being confirmed by the general meeting of the society.

THE Adams prize has been awarded by Cambridge University to Professor A. E. H. Love, F.R.S., formerly fellow of St. John's College and now Sedleian professor of natural philosophy at Oxford, for his essay entitled "Some Problems of Geodynamics."

DR. KARL CHUN, professor of zoology at Leipzig, has been awarded the gold Cothenius medal of the Halle Academy of Sciences.

DEAN H. C. COOLEY, of the University of Nebraska, Mr. Bion J. Arnold, of Chicago, and Dr. J. A. L. Waddell, of Kansas City, have received the degree of doctor of engineering from the University of Nebraska.

DR. CHAS. K. MILLS and Dr. Wm. G. Spiller, of the neurological department of the University of Pennsylvania, have been elected foreign corresponding members of the Société de Neurologie of Paris.

MISS MARY C. DICKERSON has been appointed curator of the department of woods and forestry and assistant curator in herpetology at the American Museum of Natural History.

DR. DAVID J. DAVIS, of the Memorial Institute for Infectious Diseases, of Chicago, has been appointed pathologist to St. Luke's Hospital, Chicago.

DR. FRANK M. SURFACE has resigned his position as associate biologist, at the Maine Experiment Station, in order to accept a position as biologist in the division of animal husbandry, in the Kentucky Agricultural Experiment Station at Lexington.

MR. A. IMACHI, of the Formosa Experiment Station, at Taihoku, spent the week of December 31 to January 9 with the Bureau of Plant Industry in Washington. Mr. Imachi is on his way to Yucatan to study the sisal hemp industry.

ACCORDING to Reuter's Agency the British South Africa Company has decided upon the despatch of a special commission to investigate sleeping sickness in Rhodesia. The commission will consist of Dr. Aylmer May, principal medical officer of northern Rhodesia; Dr. A. Kinghorn, of the Liverpool School of Tropical Medicine; Dr. Leach, of the Northern Rhodesian Medical Service; Mr. O. Sil-

verlock, entomologist, and Mr. Jollyman, bacteriologist.

It is stated in *Nature* that at a recent general meeting of the Liverpool Astronomical Society it was resolved to raise a special fund for the purpose of a memorial to the late Mr. R. C. Johnson, whose long connection with the society, in which he filled the positions of secretary and president, and his services in the interests of astronomical science, suggest that some permanent recognition of his work should be made.

A memorial in marble to the late Sir John Evans, the anthropologist, has been placed in the parish church of Abbot's Langley, Herts, where he lived for sixty years.

According to information received from Timbuctoo the remains of Alexander Gordon Laing, the African traveler, who was murdered in 1826 while exploring the course of the Niger, have been discovered at Saebb, some 50 kilometers north of Timbuctoo. The discovery was made by M. Bonnel de Mézières, who had been commissioned by the governor of the French Upper Senegal and Niger Colony to proceed to Taudeni, some 300 miles north of Timbuctoo, in order to examine the salt mines of the district.

Professor L. P. Kinnicutt, director of the department of chemistry in the Worcester Polytechnic Institute, well-known for his important contributions to sanitary chemistry and sewage disposal, died on February 6, aged fifty-six years.

Dr. Edward Gameliel Janeway, professor of medicine and dean of the University and Bellevue Hospital Medical College, one of the leading physicians of the country, died on February 10, aged sixty-nine years.

Dr. Willibald A. Nagel, professor of physiology at Rostock, has died at the age of forty years.

M. E. A. Léveillé, the French entomologist, has died at the age of seventy years.

Professor Eduard Hagenbach-Bischoff, formerly professor of physics at Bâsle, has died at the age of seventy-eight years.

Foreign exchanges announce the deaths of three astronomers: M. Gustav Leveau, known for his work in celestial mechanics and for more than fifty years an officer of the Paris Observatory; M. Rozé, astronomical lecturer at the École Polytechnique, Paris, and Dr. F. W. Hermann Leppig, astronomer in the Leipzig Observatory.

The Wabash College Botanical Society will this year send a representative to the Woods Hole Biological Laboratory to occupy a table which they will support.

UNIVERSITY AND EDUCATIONAL NEWS

Dr. and Mrs. Robert W. Long, of Indianapolis, have given $200,000 in real estate to the medical department of Indiana State University.

By the will of Mrs. Emily H. Moir, of New York City, Barnard College received $10,000. Harvard University, Princeton University, Lincoln University and Howard University receive shares of the residuary estate.

Illinois College, at Jacksonville, Ill., received recently $5,000 from Mr. Edward F. Goltra, of St. Louis. This contribution is towards a new endowment of $150,000 which the college is raising. Mr. Andrew Carnegie has contributed one half of the amount; friends and alumni have thus far contributed about $65,000.

Plans have been proposed to unite the University of Pennsylvania with the Pennsylvania State College and to make the relations between the university and the state more intimate.

The sum of £25,000 required for the purchase of the site for new chemical laboratories at University College, London, has been completed by a gift of £4,500 from Mr. Ralph C. Forster. The total sum required for the purchase of the site and the erection of the laboratories was £70,000.

Dr. C. H. Neilson, professor of physiological chemistry in St. Louis University School of Medicine has been made professor of medicine and director of the department. The chair in medicine has been put on a salary basis. Dr. Neilson is an A.B. from Ohio Wes-

leyan University, received his Ph.D. in physiology at Chicago in 1902 and his M.D. from Rush Medical College in 1905. Before going to St. Louis he was instructor in physiology in the University of Chicago, and at the Marine Biological Laboratory at Woods Hole.

MRS. MARGRETE BOSE has been appointed professor of chemistry in the University of La Plata. Her husband, Dr. E. Bose, is professor of physics in the university.

MR. JAMES LEES, of the University of Bristol, has been appointed lecturer in engineering in the South African College, Cape Town.

DR. FRANZ HOFMANN, professor of physiology at Innsbruck, has been called to the German University of Prague to succeed Professor Gad.

DISCUSSION AND CORRESPONDENCE

LABORATORY TABLES

TO THE EDITOR OF SCIENCE: Several months ago I read with interest in SCIENCE Professor Augustus H. Gill's suggestions for chemical laboratory furniture and fittings. Among other things he discusses various kinds of materials and surfaces for table tops. It occurs to me that it may be of sufficient interest to warrant calling attention to still another kind of surface for laboratory tables.

In our testing laboratory at The York Manufacturing Company we have tables with tops of ordinary wood. On this there are placed sheets or slabs of heavy asbestos board, one fourth inch thick. These are fastened in place by a few small brads driven around the edge. All around the outer edge of the table there is a narrow strip of wood of the same thickness as the asbestos board, making a permanent border. This, as a matter of course, is nailed in place. It prevents the edges of the asbestos from becoming frayed out. The advantages of this asbestos surface are almost self evident. Flasks and beakers containing hot water or solutions can be stood upon it without fear of their cracking. There is also little risk of breaking glassware by setting it down a little too hard, as is often the case on slate or stone or even wood, where particles of grit may happen to be. And of course the resistance of the asbestos to fire and heat is too well known to need any comment. There is the further advantage that when the asbestos slab becomes old and worn it is easily replaced without in any way disturbing the table, thus making the latter practically new.

We have found this plan highly satisfactory and pass on the suggestion for any who may desire to try it. It is quite possible that it is an old device after all.

C. H. EHRENFELD

YORK, PA.

A FORMULA FOR OPTICAL INSTRUMENTS

IN many surveying and optical instruments a ray of light is reflected by a pair of plane mirrors. And if ϕ be the angle between said mirrors; and the entering light ray lies in the plane commonly perpendicular to them; then, of course, the doubly reflected ray must cross its original path at the angle 2ϕ. And, although the ray sway from side to side; so long as it preserves its parallel position to this commonly perpendicular plane; so long also is the crossing angle still 2ϕ.

But now, should the entering ray be deflected at a variable angle θ to this commonly perpendicular plane, then the question arises as to the resultant effect upon the crossing angle, a problem that constantly arises in practise, and yet one, I believe, that the textbooks leave unanswered.

The single solution is as follows: letting ϕ be the angle between the two mirrors, and θ be the independent variable angle that the entering light ray makes with the plane commonly perpendicular to the said mirrors, while δ is the crossing angle desired. Then,

$$(\cos\theta)\ (\sin\phi) = \sin\tfrac{1}{2}\delta,$$

a very simple formula, that can be easily demonstrated by elementary trigonometry.

In the special cases where the entering ray is normally inclined to the commonly perpendicular plane, and it be asked what errors may be produced by changes in the direction of that ray? we should simply determine, first, the angle ϕ between the two mirrors, and

secondly, the angle θ that the ray was designed to have with the commonly perpendicular plane, when the above formula will prove itself, by giving us the correct bend δ in the ray that the instrument was designed to produce. Whereupon any error on deflection in the entering ray either does or does not make a new angle θ' with the commonly perpendicular plane, giving us, therefore, by the above formula the new value of δ.

Alan S. Hawkesworth
University of Pittsburgh

THE INSUFFICIENCY OF DATA ON ENVIRONMENT GIVEN IN PAPERS DESCRIBING DEEP-SEA AND OTHER MARINE ORGANISMS

To the Editor of Science: In examining a number of recently published papers on corals, foraminifera and other marine animals, especially for the purpose of ascertaining the temperature conditions under which the organisms live, I have been particularly impressed by the fact that very rarely are any definite data given on the temperature of the waters from which they were taken. As it is a generally known biological fact that temperature is one of the most influential factors in determining geographic distribution, it is highly important that precise information on this subject should be available. In fact, the data on the physical conditions under which an organism was collected should always be presented as fully as possible. Depth, temperature, nature of the bottom, and relations to marine currents, are important factors. As so many zoologists are engaged on the description of marine faunas, and as it is more or less habitual to give very meager data on the conditions under which the organisms described live, this appeal for more detailed information is made to the body of investigators through the columns of Science.

T. Wayland Vaughan

SCIENTIFIC BOOKS

The Age of Mammals in Europe, Asia and North America. By Henry Fairfield Osborn. Illustrated. New York, The Macmillan Co. 1910.

Students of paleontology have awaited impatiently the past few years a promised work on extinct mammals by Professor Osborn. In his "Age of Mammals," as it has recently appeared, expectations have been more than realized. For more than a century, beginning with the classic researches of Cuvier, our knowledge of extinct vertebrates has been increasingly widened, and of no group so greatly as of the mammals. In North and South America, throughout Europe, in India, and more recently in Africa, discoveries have followed discoveries so rapidly that all but the expert have nearly given up in despair the attempt to follow and understand. And it is superfluous to say that in no part of the world has the progress of our knowledge been so rapid as in North America. Those famous pioneers in American paleontology, Leidy, Cope and Marsh, followed soon by Scott and Osborn, and later by Wortman, Hatcher, Matthew, Merriam, Sinclair, Gidley, Peterson, Douglass, Loomis, as well as others whose names may be omitted here without invidiousness, have contributed abundantly and meritoriously to our knowledge of the history of mammalian life in North America.

But, for some years it has been growing more and more evident that it was time that an inventory should be made of what we know. And this has now been done ably by Professor Osborn in this voluminous work of more than six hundred pages. That there is no place in the world where such a work could be written as the American Museum of New York City, with its extensive collections, and various experts in paleontology, especially Dr. Matthew, for aid and advice, vertebrate paleontologists know full well. That there is no one who could treat the subject more broadly and comprehensively than Professor Osborn will, also, be as readily admitted. Indeed there are few who are competent to criticize expertly the work as a whole, as the reviewer is painfully conscious, since he knows that he is not one of them. Vertebrate paleontology has advanced with such enormous strides within the scientific career of the present writer even, that it is no longer possible for

any one to be expert in more than one of its half dozen branches. But the writer does appreciate the merits of the work, since it will relieve him, in large part, as also many others, of the almost insurmountable difficulties he has encountered in attempting to keep abreast of the discoveries in mammalian paleontology.

In brief, the work deals with extinct faunas, rather than with the evolution of mammals, with "time and place" rather than with "descent"; as the author says, it is "a study of the sources or birthplaces of the several kinds of mammals, of their competitions, migrations, and extinctions, and of the time and places of the occurrence of these great events in the world's history." As such, after the introduction, of which more later, it deals with the faunas of each great division, and its minor subdivisions, so far as possible, of the Cenozoic, geologically, geographically, environmentally and faunistically. The author makes use of whatever available assistance is afforded by other branches of paleontology in his paleogeographic and climatic discussions, though not always with the same expertness that he shows in his more special field of research, the mammals, as for instance, the statement on page 106 that *Helagris* is the oldest known American serpent. Marsh years ago described the serpent *Coniophis* from the Lance beds, and the present writer can confirm his determination; and he also objects to calling *Champsosaurus* either aquatic or a lizard. But the few such errors that the writer has observed are trivial, and it would be supererogatory to search for others.

To give even a résumé of the work would be beyond the limits of this article. Perhaps no part, other than the introductory chapter, will be of more general interest than that dealing with the Pleistocene, and especially that with man in his faunal and time relations. The writer is one who still believes, notwithstanding the objections raised by geologists and anthropologists, that there is paleontological evidence of man's contemporaneity in North America with some, at least, of the extinct mammals, and he finds of interest the summary of such evidence.

By the aid of sections, maps and photographs every known horizon of the North American Cenozoic yielding vertebrate fossils is located and defined, and correlated, so far as possible, with the horizons of other lands. For the American deposits and faunas, and to a very large extent for those of other lands, the data of this work have been brought together from original sources, and the writer has sufficient acquaintance with the literature to perceive that very few indeed have been omitted or overlooked. The numerous figures of skeletons, and photographs of restorations chiefly from the able brush of C. R. Knight, will especially commend the work to the general reader. Many of these figures have become familiar to students within recent years in special works and in texts. They are here brought together and numerous others added.

Not the least useful part of the work to the zoologist is the summary of the classification of the Mammalia in the appendix, with a list of the known genera, their range and distribution. That it will be accepted immediately by zoologists in its entirety is hardly probable. The writer for one, as a student of the extinct reptiles, demurs at the unreserved location of the Multituberculata among the Marsupialia, notwithstanding the apparently convincing discoveries of Gidley. *Tritylodon* stands, confessedly, somewhere near the dividing line between the Reptilia and Mammalia, and the relationships between *Tritylodon* and the Multituberculata seem so clear that one can not accept the necessary conclusion that the reptiles evolved directly into marsupials. That some or all of the Multituberculata will some time be proved to be oviparous the writer firmly believes, and there are others who believe so with him. The author accepts not less than thirty-four orders of Placentals, arranged under four chief groups, the Unguiculata, Ungulata, Primates and Cetacea. We need to add but three or four more "cohorts" of equivalent rank—and the author may rest assured that some of his zealous colleagues will promptly do so—and we again have essentially the older classification under new names. There is a similar

tendency in all branches of natural history; and the writer deplores it. Is it not just as well to call these chief groups orders with as little disturbance as possible to existing plans of classification? For, after all, it seems to be merely a question of names. However, classification of organisms is an art that passes understanding, and no one knows where it will end; possibly when all the species have been raised to genera and all the genera to families, and families to orders, etc.

Perhaps the most widely useful part of the work is reserved for the conclusion of this review—the introductory chapter. In this the author brings together in a readable way the underlying principles of paleontology, with especial reference to mammals, but also widely applicable, not only to all branches of paleontology, but to all natural history as well. The philosophy of structure, correlation, range, environment, the laws of evolution as applying to mammals in general and in detail, are among the subjects treated. Not all is discussed that might have been; not all the conclusions are beyond controversy, but, withal, it is the best summary of the guiding principles of paleontological research the writer has seen.

The writer can not recommend the work as one suitable to slip into one's grip for literary recreation on a vacational outing—it is a little heavy and forbidding in places. As a work of reference for the geologist and naturalist it is indispensable; and it will be a working tool for the student of extinct mammals. Perhaps, with the publication of this work there will no longer be an excuse for the further display of the dense ignorance concerning extinct forms that characterizes the most of our text-books in zoology—at least let us hope so!

In conclusion it may be said that this inventory of extinct mammals has been well done; the way is again cleared for a further rapid expansion in our knowledge of this class of vertebrates. And the author is to be commended and congratulated on the opportunities he has aided in opening up.

S. W. Williston

Catalogue of the Nearctic Hemiptera-Heteroptera. By Nathan Banks. Philadelphia, Pa., American Entomological Society. 1910.

This catalogue covers the entire group of Heteroptera for the Arctic region, and in this respect is of much greater service to the American student than the general catalogue of Kirkaldy which includes only a few of the families represented in this region. The work is rather a presentation of the existing knowledge than an attempt to rearrange the grouping or to introduce radical changes in the generally accepted nomenclature. The list covers 1,268 species and is particularly serviceable in certain families which have not been treated in recent years. Such a catalogue has been much needed, as the only work of a similar character, the list by Dr. Uhler, published over twenty years ago, is long since out of date. The paper shows some defects in proof reading, as for instance, the misspelling of *Macrovelia* and *Zicrona,* but on the whole it seems to be quite free from serious error. We can certainly share with the author the hope "that this catalogue will encourage entomologists to devote more time to this order, so that our forms will be better known to us."

Herbert Osborn

The Relation between Chemical Constitution and some Physical Properties. By Samuel Smiles, D.Sc., New York, Longmans, Green and Co. 1910.

The study of the relations between the chemical constitution and the physical properties of substances has interested chemists and physicists for a greater period of time than has the study of any other branch of chemistry which possesses more or less general interest at present. For this reason, the volume under review should exert a wider appeal than any which have appeared in the series of "Text-books of Physical Chemistry" edited by Sir William Ramsay, of which it forms a part. As part of a physical chemistry series it will appeal to physical and inorganic chemists, and it will also appeal to organic chemists, since as stated by Professor Smiles

in the preface, it has been written "from the standpoint of organic chemistry."

The subject matter is discussed under the following headings: Mechanical Properties, under which are treated Capillarity, Viscosity and Volume Relations; Thermal Properties, including Specific Heat, Fusibility and Boiling Point; Optical Properties, including Refractive and Dispersive Power, Absorption of Light, Fluorescence and Magnetic Rotatory Power; and Electric Property, including a short chapter on Anomalous Electric Absorption.

In an introductory chapter, the development of the study of the physical properties is traced and the gradual increase in importance of these properties as aids in determining chemical constitution is clearly brought out. The concluding statement of this chapter that in determining chemical constitution "evidence drawn from physical properties should be regarded as subordinate to chemical evidence" will be concurred in by most chemists. In the sections dealing with the Mechanical and Thermal Properties, an unsatisfactory impression is obtained at times with regard to the scope of the theoretical treatment as well as the application to the experimental data. On the other hand, in fairness to the author, it must be said that with the space at his disposal a more satisfactory treatment of these subjects is scarcely possible. The same criticism does not apply to the chapters in which the optical properties are discussed, as here the treatment is clear and complete, especially in describing the relations which have been deduced between absorption and chemical constitution. The additive and constitutive effects exerted by the atoms and groups of a molecule upon each property are carefully distinguished throughout and illustrated by concrete examples.

The concluding chapter considers the present status of the subject and the most fruitful lines for further investigations. In the opinion of the author, the study of the optical properties, including absorption and refraction, offer the greatest promise, but further advance along these lines depends upon a satisfactory theory of valence. This, it is pointed out, is the most important problem awaiting solution from the chemist, and "the electronic theory seems to be the only means by which there is any prospect of attaining further knowledge of the nature of valence."

K. G. FALK

Chemische Krystallographie. By P. VON GROTH. Leipzig, Wilhelm Engelmann. 1910. Vol. 3. Pp. iv + 804, 648 figures; 8vo, cloth, 30 Marks. (Volume IV. is in preparation.)

In 1904 Professor P. von Groth, of the University of Munich, published his "Einleitung zur Chemischen Krystallographie," and followed it two years later with the first volume. In 1908 the second volume of the "Chemische Krystallographie" was issued. These volumes have all been reviewed in SCIENCE.[1]

Groth's "Chemische Krystallographie" is a work of monumental proportions, and is to include the crystallographic data of all substances which have been described at the time of the publication of the individual volumes. Inorganic compounds were discussed in volumes I. and II. The third and fourth volumes are to be devoted to organic compounds. In volume III., which has just been published, crystallographic data are given for the aliphatic carbon compounds, hydrobenzol derivatives and terpenes. The method of treatment in this volume is the same as in the others, according to which all substances having a similar chemical composition are placed together and their descriptions prefaced by a discussion of the work done on the group. These discussions are suggestive as well as critical in character and make the work of much more value than a mere compilation of chemical crystallographic data could be. This volume, as well as volume IV., which it is hoped will be published before long, ought to prove of especial value to organic chemists.

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[1] Vol. XXV., 143–144; Vol. XXVIII., 843.

DO FERNS HYBRIDIZE?

In a paper entitled "Physiological Aspects of Fertilization and Hybridization in Ferns,"[1] Dr. W. D. Hoyt gives considerable space to the evidence heretofore brought forward to prove hybridity among ferns. After considering the evidence under three headings, viz., (*a*) characters of the mature sporophyte, (*b*) experiments in which prothallia of different species have been grown together and some of the resulting plants have been considered intermediate, (*c*) experiments in which sperms of one species have been presented to eggs of another species, and their behavior watched, he concludes that the affirmative evidence is entirely insufficient, and that the only evidence which is worthy of consideration is negative. He also adduces what he considers additional negative evidence based on his study of the behavior of the gametes of certain ferns with which he worked.

Dr. Hoyt's paper deserves consideration for its physiological features. His experiments and observations as to the behavior of the sperms and the fusion of the gametes are extremely interesting. Unfortunately, however, the paper does not deserve serious consideration with respect to his conclusions regarding the evidence as classified under the first two headings. His conclusions on these points carry no weight whatever, because they are not based on a first-hand knowledge of the facts concerned.

For example, in order to be sure of the identity of the common ferns with which he worked, such as *Dryopteris Thelypteris,* he felt obliged to send his material to Mr. W. R. Maxon for identification. What weight then can his opinion carry with regard to what forms constitute reasonable variations of these common species and what forms are so different as to deserve a specific if not a hybrid rank? Dr. Hoyt's work with fern hybrids suggests the story which is told of a certain (or rather uncertain) investigator of the embryology of a species of *Pinus* who did not know the tree in life. Moreover, when Dr. Hoyt was beginning his study of this particular problem at the New York Botanical Garden, he did not even care to examine ample material of nearly all the reputed hybrids of *Dryopteris,* although he was offered every opportunity to do this. Apparently his mind was already made up on this point. He wished only to see the experimental plants which Miss Slosson produced by planting in pairs unisexual portions of the prothallia of *Dryopteris cristata* (L.) Gray and *D. marginalis* (L.) Gray, and *Asplenium platyneuron* (L.) Oakes and *Camptosorus rhizophyllus* (L.) Link, respectively. The fact that these experimentally produced plants are identical with the wild plants described as the hybrids of these pairs of species, Dr. Hoyt explains easily by suggesting that all may be mere variations. If he had known well the parent species and the reputed hybrids, he could not have made such a suggestion. Either there are hybrids in *Dryopteris,* et al., or else there are a considerable number of undescribed new species.

The third class of evidence is the only kind of which Dr. Hoyt has any adequate knowledge, and even here his unfamiliarity with the wild plants has reduced to a vanishing point the negative value of that which he presents. Thus he cites as the main evidence which he offers to disprove hybridity among ferns, the fact that he was unable to cause fusion between the gametes of two species which no one has ever suspected from field study to be in the habit of crossing, *i. e.,* *Dryopteris Thelypteris* (L.) Gray and *Dryopteris noveboracensis* (L.) Gray. Sixty-seven attempts he records as having been made to secure the fusion of an egg of one of these with the sperm of the other, but, as he observes, most of the eggs "looked bad," that is, incapable of fertilization, so that his main conclusion rests on a few attempts to cross two species which a knowledge of the wild plants would have warned him not to use. It is to be regretted that he did not try to cross *Dryopteris cristata* with *Dryopteris marginalis.*

He reports four negative attempts to cross *Asplenium platyneuron* (L.) Oakes with *Camptosorus rhizophyllus* (L.) Link, between

[1] *Bot. Gaz.,* 49: 340–370, 1910.

which a natural suspected hybrid is known, a duplicate of which Miss Slosson produced culturally. Most of his experiments at crossing were made with species in unrelated genera, *e. g., Pteris* and *Athyrium,* two genera belonging in entirely different tribes. Also, he cites as the best evidence previous to his paper the work of C. Voegler, who was unable to obtain fusion between the sperms and eggs of several pairs of unrelated fern genera, some of them genera from very distinct families, *e. g., Ceratopteris* and *Dicksonia, Dicksonia* and *Nephrolepis,* et al.

The case, then, for fern hybrids, stands just where it did and is based on facts which require reasonable explanation. The evidence favoring hybrids has been fully presented, and does not need recapitulation. It is quite true that experimental proof of the kind attempted by Hoyt and Voegler is lacking. No one has ever observed the development of a suspected hybrid from before the period of fusion of the gametes. But such evidence is not usually required in cases of reputed hybridity. The arguments advanced by Mr. Hoyt against fern hybridity apply with practically equal force to most cases of accepted hybridity among flowering plants and in animals.

In conclusion, then, these reputed fern hybrids possess in all respects the characters generally recognized as characteristic of hybrids. The existence of these plants demands some explanation, and their identification as hybrids furnishes the simplest and most reasonable one yet offered.

RALPH C. BENEDICT
COLUMBIA UNIVERSITY

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE AND AFFILIATED SOCIETIES
SECTION B—PHYSICS

THE annual meeting of the American Association for the Advancement of Science, Section B, Physics, was held in the physical laboratory of the University of Minnesota, at Minneapolis, December 28–30, 1910. It was a joint meeting with the American Physical Society. Three forenoon and three afternoon sessions were held. Of these, two were "general interest" sessions, in charge of the officers of Section B and four were occupied with the reading of research papers, in charge of the American Physical Society.

The presiding officers were Dr. E. B. Rosa, vice-president of Section B, and Professor Henry Crew, president of the Physical Society. At a short business session of Section B Professor O. M. Stewart was elected a member of the council, Professors A. Zeleny and K. E. Guthe members of the sectional committee and Professor G. W. Stewart a member of the general committee.

All sessions were held in the lecture room of the Physics Building of the University of Minnesota. The dinner on Thursday evening with the mathematicians and engineers at the Commercial Club was a very pleasant and enjoyable occasion.

The officers for the next annual meeting, to be held in Washington during the convocation week of 1911–12, are as follows:

Vice-president and Chairman of Section B—Professor R. A. Millikan, University of Chicago.

Retiring Vice-president—Dr. Edward B. Rosa, Bureau of Standards, Washington.

Secretary—Professor Alfred D. Cole, Ohio State University, Columbus.

Members of the Sectional Committee—E. B. Rosa, R. A. Millikan, A. D. Cole, K. E. Guthe, A. P. Carman, G. F. Hull, E. L. Nichols, A. Zeleny.

The address of the retiring chairman of Section B, Dr. L. A. Bauer, was given Thursday afternoon on the subject "The Broader Aspects of Research in Terrestrial Magnetism." This was a joint session with Section D, whose vice-presidential address was delivered at the same time by Professor J. F. Hayford, on "The Relation of Isostasy to Geodesy, Geology and Geophysics." The former of these addresses is presented in full in SCIENCE, January 13, 1911, and the other will be published soon.

At the other general interest session the following program was presented:

"Recent Advances in Phosphorescence and Fluorescence," Professor Edw. L. Nichols, Cornell University.

"The Isolation of Ions," Professor R. A. Millikan, University of Chicago.

"The International Electric Units" (report on changes to go into effect January, 1911), Dr. E. B. Rosa, Bureau of Standards, Washington.

"Osborne-Reynolds's Theory of Gravitation," John Mackenzie, M.E., Minneapolis.

Abstracts of three of these papers follow. (That of Professor E. L. Nichols will probably appear in the next issue.)

The Isolation of Ions: Professor R. A. MILLIKAN.

This paper presented the methods used and the results obtained thus far in the work on the properties of isolated ions. It contained a more complete discussion of the material which was summarized in the issue of SCIENCE of September 30, 1910, and in addition new results obtained in collaboration with Mr. Harvey Fletcher—(1) on the question of valency in gaseous ionization, (2) on the causes of the irregularities obtained by Ehrenhaft in Vienna in his recent work on e. The new work only is here briefly summarized. The tabulated experimental data upon which the conclusions rest are soon to be published elsewhere.

1. In the work previously published it was conclusively shown that the great majority of atmospheric ions carry the elementary electrical charge, but there seemed to be some evidence that ions of larger valency were occasionally formed. This evidence was found in the fact that an oil drop suspended in a strong electrical field would occasionally catch, under the influence of radium, two or three elementary charges at once *when the field was on.*

The only preceding evidence in favor of the existence of valency in gaseous ionization is contained in the experiments of Townsend[1] and of Frank and Westphal,[2] which seemed to their authors to establish the production of some doubly valent positive ions by X-rays, but not by other ionizing agents.

We accordingly suspended minute drops of oil in an electrical field and produced a thin sheet of X-ray ionization in the air just beneath the drop, but no rays were allowed to fall upon the drop itself. The drops experimented upon were positively charged and the direction of the field was such that only positively charged ions could be thrown upon them. *Although we used rays of varying degrees of hardness we found in 125 catches not one which represented the advent of a multiple charge upon the drop.* These experiments present therefore direct, definite, unmistakable proof that the act of ionization of air by primary X-rays, even when these rays are of extreme hardness, consists in the separation of one single elementary charge from a neutral molecule.

[1] *Proc. Roy. Soc.*, 80, p. 207, 1908; 81, p. 464, 1908, and 82, p. 18, 1909.

[2] *Verh. d. D. Phys. Ges.*, März, 1909, and Juli, 1909.

When β rays of radium were used as the ionizing agent it was occasionally found possible, as in the work previously reported, to catch at once upon a single drop two or three elementary charges, *provided the drops were of sufficient size; but when the drops were very small we caught only singles.* This shows we think that all of the double and treble catches heretofore observed were due to the simultaneous catching by a large oil drop of two or three ions coming from two or three different molecules rather than to the separation from a single molecule of two or three elementary charges. In other words the capture of a number of elementary charges at once upon large drops furnishes no argument for the production of ions carrying two or more elementary charges, unless similar results can be obtained with small drops, and this we never found to be the case. Since it was only in the case of X-rays that evidence for valency in gaseous ionization had been previously found *the present experiments seem to remove all ground for supposing that the act of ionization of a gas ever consists in the expulsion from a single molecule of more than one elementary electrical charge.*

2. When we used oil drops of smaller radius than about .00004 cm. we found that the remarkable consistency in the successive values of the times of fall under gravity shown in the work previously published (see SCIENCE, September 30) was replaced by greater and greater irregularities as the drops became smaller and as the distance between the cross hairs was diminished. The explanation lies in the fact that the displacements due to Brownian movements become in such cases comparable with the displacements produced by gravity during the time of observation. The correctness of this explanation is proved conclusively by tables prepared by Mr. Fletcher which show that the observed distribution of "times of fall" between fixed cross hairs .07 mm. apart agrees perfectly with the distribution of these times *computed* from the theory of probability as applied to Brownian movements. These considerations offer a complete explanation of the irregularities observed by Ehrenhaft, since he used a cross hair distance of about the value mentioned above and worked with particles the radii of which were on the average about one fifth of those of our smallest drops previously reported upon.

Ehrenhaft's failure to observe Brownian movements with platinum and gold particles while he

saw them clearly with "phosphornebel" is presumably due to the fact that, the kinetic energy of agitation of all particles being the same, the *velocity* of agitation of a platinum particle would be but about one fifth of that of a particle of like size in a cloud of phosphorus despite the fact that, as shown by Einstein's formula,

$$\overline{X}^2 = \frac{RT}{N^3 \pi a \mu} \tau,$$

the displacement along X in a time τ would be the same for the two particles. In other words, while the "drift" of a Brownian particle is inversely proportional to its radius and *independent of its mass*, the "instantaneous speed" of a particle of given radius is inversely proportional to the square root of its mass. There is then nothing whatever in Ehrenhaft's work to raise a suspicion as to the correctness of any of the conclusions which have been drawn from our observations.

The International Electrical Units: Dr. E. B. ROSA.

The international electrical units current in all countries throughout the world are based upon the definitions and numerical values adopted at Chicago in the International Electrical Congress of 1893, except that the numerical value of the standard cell, adopted by Germany and some other countries, was slightly different from that recommended by the congress, which latter value was legally adopted in America, England, France and some other countries. In order to secure international uniformity so that the ampere and the volt, as well as the ohm, should be the same in every country, an international research was carried on at the Bureau of Standards, during April and May of last year, in which the standards of the national laboratories of England, France and America were compared and the silver voltameter was investigated. As a result of this cooperative effort, the International Committee on Electrical Units and Standards has agreed to recommend to all the governments represented in that committee the adoption of a new value for the Weston Normal cell, which has the effect of changing the numerical value of the international volt and also of the international ampere. The new value of the Weston Normal cell, at 20° C., is 1.0183. The previous value in America was 1.0191, whereas in Germany it was 1.0186, and in England for the last two years it has been 1.0184 although previously it was higher than the value in this country. There will be, as soon as the new value has been generally adopted, international uniformity with respect to the value of the units of resistance, current, voltage and power. It will, of course, require some time before the new values come into general use, although it is expected that they will be officially adopted in all countries at an early date. The Bureau of Standards adopted the new value January 1, 1911, and certificates issued by the bureau after that date will be in terms of the new units. The difference is, of course, inappreciable in ordinary engineering operations, but is very important in precise measurements, and is appreciable even in photometric measurements of electric lamps, in which the voltage or current, or both, are given.

Osborne-Reynolds's Theory of Gravitation: Mr. JOHN MACKENZIE, M.E., Minneapolis.

In contrast with the ordinary view that space is filled with an ether of very low density, Reynolds's view is that space is filled with a granular medium of very high density. The grains are small, hard spheres. The density of this medium is 10,000 times that of water. The grains are usually arranged in "normal piling." Where matter exists this arrangement is disturbed and a less number of grains occupies the same space. This is "abnormal piling." Matter is then negative mass. An atom of matter consists of a nucleus of grains in normal piling surrounded by a shell of grains in "abnormal piling."

The grains have motion relatively to one another, but the mean path of the motion is only a very small fraction of their diameter. This motion renders the medium elastic. An experiment with billiard balls was used to illustrate mass motion in space, defined as a "coming in of grains in front and leaving of grains in the rear."

To illustrate the difference between normal and abnormal piling of grains a rubber balloon filled with sand and water was subjected to pressure by placing a 75-pound weight upon it. The sinking of the liquid in an attached manometer tube showed that the addition of the weight *increased* the total volume of the intergranular spaces occupied by the water.

Reynolds holds that there is no attraction residing in masses of matter, but where abnormal piling (bodies of matter) exist, the pressure of the surrounding medium tends to restore normal piling and incidentally masses are driven together. This is gravitation.

The theory is also applied to the explanation of cohesion, electricity, magnetism, light and other physical phenomena.

At the joint sessions for the reading of research papers the following list was presented:

"The Ratio of the Two Heat Capacities of Carbon Dioxide as a Function of the Pressure and the Temperature," A. G. Worthing, University of Michigan.

"On the Adiabatic Expansion and Porous Plug Effect in Water between 0° and 40°," John R. Roebuck, University of Wisconsin.

"The Acoustic Shadow of a Sphere; the Theory and Certain Practical Applications," G. W. Stewart, State University of Iowa.

"On the Function of Rest in Restoring a Platinum-iridium Wire to its Annealed Condition," L. P. Sieg, State University of Iowa.

"The Nature of the Recovery of Light-positive and Light-negative Selenium," F. C. Brown, State University of Iowa.

"On the Fluorescence Spectra of the Uranyl Salts and the Structure of Luminescence Spectra in General," Edward L. Nichols and Ernest Merritt, Cornell University.

"The Effect of Red and Infra-red on the Decay of Phosphorescence in Zinc Sulphide," Herbert E. Ives and M. Luckiesh, National Electric Light Association, Cleveland, O.

"Ocean Currents and Barometric Highs," W. J. Humphreys, Mount Weather Observatory, Bluemont, Va.

"Ocean Currents and Barometric Lows," W. J. Humphreys, Mount Weather Observatory, Bluemont, Va.

"The Light-emission of Tungsten, Tantalum and Carbon as a Function of their True Temperature," C. E. Mendenhall and W. E. Forsythe, University of Wisconsin.

"The Pentane Lamp as a Primary Light Standard," E. B. Rosa and E. C. Crittenden, Bureau of Standards.

"Experimental Indications of the Nature of Magnetism," S. R. Williams, Oberlin College.

"The Effect of Magnetization on the Optical Constants of the Magnetic Metals," L. R. Ingersoll, University of Wisconsin.

"The Second Postulate of Relativity," O. M. Stewart, University of Missouri.

"A Preliminary Report of Experiments on the Effect of Changes in the Pressure of Gases upon the Mobility of Positive and Negative Ions Produced by the Discharge of Electricity from a Fine Point," E. J. Moore, Oberlin College.

"The Transmission of Excited Radioactivity," Wellish, Yale University.

"The Coefficient of Recombination of Ions in Carbon-dioxid and Hydrogen," Harry A. Erikson, University of Minnesota.

"A Method of Measuring the Fluctuations in a Rapidly Varying Resistance," F. C. Brown and W. H. Clark, State University of Iowa.

"The Causes of Zero Displacement and Deflection Hysteresis in Moving-coil Galvanometers," Anthony Zeleny, University of Minnesota.

"The Effect of Wave Form upon Incandescent Lamps," M. G. Lloyd, Chicago, Ill.

"Diffraction and Secondary Radiation with Short Electric Waves," A. D. Cole, Ohio State University.

"Notes on the Discharge of Electricity through Gases," G. S. Fulcher, University of Wisconsin.

"The Free-expansion and Joule-Kelvin Effects in Air and in Carbon Dioxide," A. G. Worthing, University of Michigan.

"On the Temperature Coefficients of the Free and the Absorbed Charges in Electric Condensers," Anthony Zeleny, University of Minnesota.

"Terminal Velocity of Fall of Small Spheres in Air at Reduced Pressures," L. W. McKeehan, University of Minnesota.

"The Electrical Discharge between a Pointed Conductor and a Hemispherical Surface in Gases at Different Pressures," Franz A. Aust, University of Minnesota.

"The Effect of Distance upon the Electrical Discharge between a Point and a Plane," O. Hovda, University of Minnesota.

"A Lecture Electroscope for Radioactivity."

"A Variable High Resistance of India Ink on Paper," Franz A. Aust, University of Minnesota.

"The Electrical Discharge from Liquid Points," John Zeleny, University of Minnesota.

"A Microscope Plate Micrometer," John Zeleny and L. W. McKeehan, University of Minnesota.

"A Kinetic Theory of Gravitation," Chas. F. Brush, Cleveland.

"On a Variation in the Intensity of the Penetrating Radiation at the Earth's Surface observed during the Passage of Halley's Comet," Arthur Thomson, University of Toronto.

"On the Resolution of the Spectral Lines of Mercury," J. C. McLennan, University of Toronto.

"Infra-red Gratings," C. F. Brackett and A. Trowbridge.

"The Question of Valency in Gaseous Ionization," R. A. Millikan and Harvey Fletcher.

"A Probable Explanation of the Irregularities obtained by Ehrenhaft and Przibram in their Work on the Value of the Elementary Electrical

Charge," Harvey Fletcher, University of Chicago.

"Note on a Form of Spectrophotometer," Edward L. Nichols and Ernest Merritt, Cornell University.

A. D. COLE,
Secretary, Section B

SECTION G—BOTANY

AT the convocation week meetings in Minneapolis, Section G held two sessions, one on Wednesday afternoon, December 28, and the other on Friday morning, December 30, under the vice-presidency of Professor R. A. Harper. Dr. William Crocker served as secretary in the absence of the regular secretary, Dr. Henry C. Cowles. The customary address of the retiring vice-president was necessarily omitted, owing to the death of Professor Penhallow. The program consisted of four special addresses and a number of technical papers, abstracts of which appear below.

The section unanimously adopted the following resolution regarding the death of Vice-president Penhallow: The botanists of the American Association for the Advancement of Science note with sorrow the absence from our meetings of David Pearce Penhallow, long a member of the association and a year ago the vice-president for the Section of Botany. We shall miss his tall impressive figure, his kindly voice and his keen and discriminating discussion. We here inscribe upon the minutes of the Section of Botany this tribute to his worth, and request the council of the association to make an appropriate entry upon its record.

Upon motion of Professor Newcombe, it was unanimously voted to request the council to appoint a committee to investigate the conditions for research in the Bureau of Plant Industry.

The following officers were chosen:

Vice-president—Professor F. C. Newcombe.

Member of the Council—Professor F. C. Newcombe.

Member of the Sectional Committee (five years)—Professor L. H. Pammel.

Member of the Sectional Committee (one year, to fill the vacancy caused by the death of Professor Barnes)—Professor L. R. Jones.

Member of the General Committee—Professor C. E. Allen.

SPECIAL ADDRESSES

Imperfect Fungi as Causes of Wheat-sick Lands and of Deterioration in the Quality and Yield of Wheat: H. L. BOLLEY (abstract below).

The Organization of the Fruit-bodies of Hymenomycetes: A. H. REGINALD BULLER.

A Summary of Ecological Results from Colorado: FREDERIC E. CLEMENTS.

A South Sea Botanical Trip: JOSEPHINE E. TILDEN.

ABSTRACTS

The Work of Imperfect Fungi in Cereal Crop Deterioration: HENRY L. BOLLEY.

This paper gives an outline of experiments conducted at the North Dakota Agricultural College, dealing with the relation of the imperfect fungi in cereal cropping.

The essential conclusions may be summarized about as follows: the soils of the older wheat areas of the northwest are in the same sort of sanitary condition as the old flax-cropped lands and may quite properly be spoken of as wheat-sick or wheat-tired in the same sense as has previously been shown for flax lands. Wheat and other cereal lands are not necessarily depleted chemically as indicated by many agricultural and chemical writers, but may be only incapable of producing proper yields because of poor sanitary conditions in the soil or in the seed.

Soil and seed-born diseases have been and are the agents which vitiate the conclusions of many well-planned schemes of agriculture, as, for example, in fertilizer trials and crop rotations. These diseases, in large measure, account for the types of soil deterioration which agriculturists have had largely under discussion; much of the supposed improvement which has been described by such writers as applicable to special systems of cropping and of soil fertilizing have, in large measure, been due to bettered sanitary conditions rather than especially improved conditions as to soil fertility.

The genera of fungi which have been worked out as destructive to flax, wheat, oats and barley are found to belong to the old group of *Fungi imperfecti.* Of these the chief ones are *Helminthosporium, Colletotrichum, Fusarium, Macrosporium* and *Alternaria.*

There may be several species of each of these different genera at work. By cross infection, it is found that some of the kinds which attack wheat also attack barley. It is particularly interesting to note that practically all of the kinds which attack wheat also attack quack-grass. This accounts in large measure for the destructive influences which quack-grass has upon the development of the young cereal crop over quack-grass areas.

Chief among the lines of work which have en-

abled the investigators to arrive at definite conclusions, has been the development of a disease propagation garden whereby the struggle for existence of the crop plants against great odds has been carefully noted and the attacking plants observed.

In summarizing, attention is called to the bearings of these findings upon agriculture and upon the various lines of investigation. Proper consideration of sanitary methods of handling soil and seed will prove a great boon to cereal crop growers but in order to accomplish this, it may be necessary to rearrange the methods of fertilizing soils and our systems of crop rotations. These observations regarding the persistence of disease in the seed and in the soil will, of necessity, materially change our ideas as to why one crop does better after than before some other crop. These observations, it is thought, explain many of the anomalies of farm cropping: why certain methods of manuring result in shrivelling of seed wheat; why the attacks of rust are so destructive; why proper seed treatment has always resulted in better yields than could be explained by the presence or absence of smut alone; why the corn crop has proved to be such a beneficial crop to precede wheat, etc.

In closing, attention is called to the extensive work of the Bureau of Soils of the Department of Agriculture upon so-called toxins in the soil; the troubles which they describe may not, of necessity, rest primarily in the soils. Before material progress is made in the amelioration of conditions of cereal agriculture, proper consideration of soil and seed sanitation will prove to be the center about which great modifications in our present methods of agriculture must be shaped.

The Succession of Vegetation in Ohio Lakes and Ponds: Alfred Dachnowski.

Along the line of "watersheds" in Ohio are a number of lakes and ponds in various stages of "filling." Almost throughout, the surface vegetation is one that is common to bogs. In relatively undisturbed areas there is a zonal arrangement. An attempt is made at a classification of the formations, and a formulation of the laws of succession involved in the comparative study.

Forest Dynamics on Isle Royale, Lake Superior: William S. Cooper.

The dominant forest of Isle Royale is composed mainly of three tree species—balsam fir, paper birch, white spruce. The relations of these to each other are as follows: Spruce and birch form a small proportion of the forest if all ages are considered, but a large proportion of the mature stand. The few large trees of these species are very conspicuous, while young ones are hard to find. Balsams of all sizes, especially small, are exceedingly numerous. The appearance is therefore of rapid succession, the balsam succeeding the other species.

Quadrat studies of selected areas, with the ages of all trees in the quadrats determined, shows tnat this appearance is deceptive. The forest as a whole is in equilibrium, but a given area is continually changing in composition and in the relative proportions of the different tree species. The changes are due primarily to the fact that all three species require considerable light during their early stages. One generation in a given area prevents reproduction until maturity or some accidental cause brings about its destruction. Windfall, by allowing light to reach the ground, is the commonest cause of the beginning of a new generation. In windfall areas young tree growth soon springs up, usually predominantly balsam, owing to the ready germination of this species. Balsam never becomes predominant in the mature stand, in spite of high reproduction, because of high mortality. The reproduction of birch and spruce is low, but their mortality is also low.

The result of these processes is that equilibrium is maintained in the forest as a whole. The dominant forest is therefore the Climax Forest of the island.

Observations on the Underground Stems of Symplocarpus and Lysichiton: C. O. Rosendahl.

The underground stems of *Symplocarpus fœtidus* and *Lysichiton camtchatcense* are true sympodia, although the fact is not readily perceived on account of their thickness. They grow very slowly, adding only from 3–8 mm. to their length yearly.

On full-grown plants, five to six renewal shoots, or joints, of the sympodium are produced each year. In *Symplocarpus* each renewal shoot or joint bears two foliage leaves, a spathe and an inflorescence. In *Lysichiton* each joint bears in addition two bracteal leaves, and the last 1–3 leaves in the fall are much reduced foliage leaves, *i. e.*, green leaves with very small laminæ; in *Symplocarpus* the first 2–3 leaves to appear in the spring are scale leaves.

Symplocarpus sends up and matures only 1–2 inflorescences a year. The others become arrested and remain in between the broad bases of the foliage leaves. *Lysichiton*, on the other hand, matures from 2–4 inflorescences yearly.

The habit of these two aroids in producing from 2–5 inflorescences in excess of the number they are capable of maturing each year is to be explained in the light of their tropical origin and in their previous more southerly range.

Some Effects of Severe Freezing upon Vegetation in a Condition of Active Growth: F. K. BUTTERS and C. O. ROSENDAHL.

On the night of April 15, 1910, the temperature at Minneapolis fell to 27° F., and a week later to 19° F. with a high wind. At the time of these frosts vegetation was in an advanced state, many trees were in full leaf, and nearly all others in active growth. Observations were made upon about seventy species of woody and herbaceous plants. It was found that besides the injury due directly to cold, much mechanical injury resulted from loss of turgidity in succulent young shoots during the early stages of freezing, and from the extreme brittleness of hard frozen leaves and twigs which the wind snapped off in great numbers. The second freeze injured many plants which were not hurt by the first one. About 42 per cent. of woody species lost practically all their foliage, only about 10 per cent. were relatively uninjured. Mature leaves and those just unfolding from the bud were less injured than half-grown leaves of the same plant. In about 60 per cent. of the species the twigs of the new growth were killed or severely injured. In about 15 per cent. the twigs of the past season's growth, and in a few instances older twigs, were injured. Flower buds were somewhat more tender, open flowers and fruits much more tender than vegetative parts. Damage to native herbaceous plants was mainly mechanical, and relatively slight except in the case of open flowers and fruits. A few weeks afterwards herbaceous vegetation appeared normal while woody plants had just begun to recuperate. The most usual types of recuperation in trees and shrubs were: (1) when the twigs were uninjured and the terminal bud intact, this often made a further growth bearing a new crop of leaves; (2) when the outer parts of the new twigs were destroyed while the basal parts remained intact, lateral shoots often arose from the leaf axils of these uninjured portions either with or without the intervention of scaly buds; (3) many latent buds started into growth upon the woody twigs, sometimes upon those several years old. In some cases all these methods of recuperation appeared in the same plant.

Color Photography in Botanical Work: FRANCIS RAMALEY.

Botanists can make use of the new color photography especially in studies of ecology and plant breeding. Many features of vegetation are brought out much more clearly than by ordinary photography. Thus, a moor with scattered shrubs or a lake-margin surrounded with belts of different plants can be well shown. In plant-breeding experiments the appearance of the different hybrids and extracted forms can be reproduced with much faithfulness. Colored plates from books are easily reproduced upon lantern slides. The exposure required is about 200 times that for an extra rapid isochromatic plate. Hence no "snap shots" can be taken, but if the light is good there need be no difficulty in securing good results. Development can be carried out in an ordinary dark room. The solutions used are inexpensive and easily prepared.

Respiration (CO_2 Production) in Air, in Nitrogen and in Hydrogen: B. M. DUGGAR and GEORGE R. HILL, JR.

The experiments reported give data respecting the rate, continuance and decline of anaerobic respiration (CO_2 production) in nitrogen and hydrogen as compared with aerobic respiration under otherwise similar conditions. The plant materials used were slices of sugar beet and germinating seed. Special attention is also drawn to the importance of an available nitrogen supply for other physiological purposes.

The Flora of the Olympic Peninsula, Washington: ALBERT B. REAGAN.

The Olympic peninsula in northwest Washington comprises a wide coastal strip bordering on the Pacific Ocean, the Strait of Juan de Fuca and Puget Sound, surrounding a totally isolated, central high area termed the Olympic Mountains. These occupy an eroded domed area in the east central part of the peninsula, with a western limb extending in declining altitude to Cape Flattery. The peaks in the central area range from 6,000 to 8,130 feet in height, Mount Olympus being the highest peak. The domed surface causes a radial drainage in all directions, but the larger streams flow into the Pacific.

This peninsula with its lofty peaks stands first in the path of the moisture-bearing southwesterly winds from the Pacific, hence the precipitation is great; at the coast it is usually rain, in the mountains snow. The precipitation averages 40 inches north and east of the mountains; west of the mountains at an elevation of 3,000 feet, about 80 inches; and in the Pacific and upper-Strait-Flattery region, 100 to 120 inches. The climate,

also, is controlled by the prevailing warm winds from the western ocean; at the coast line snow is seldom seen.

Under such an equable climate and abundance of rainfall, the peninsula, with few exceptions, is the most densely forested region in our country; and smaller plants do equally well. Of course as one approaches the mountains the forest becomes less dense till the timber line is reached; but in the reverse proportion the flowering herbs at the same time increase in number and beauty. The region in the lower levels is a jungle of trees, shrubs and entangled vines.

About 200 square miles of the timbered area has been burned over; 260 square miles is naturally timberless, lying just at timber line; and 150 square miles consist of ice and rocks.

The most conspicuous plants of the peninsula are red fir (*Pseudotsuga taxifolia*), lovely fir (*Abies amabilis*), subalpine fir (*Abies lasiocarpa*), white pine (*Pinus monticola*), red cedar (*Thuja plicata*), Alaska cedar (*Chamæcyparis nootkatensis*), Sitka spruce (*Picea sitchensis*), Merten's hemlock (*Tsuga Mertensiana*), vine maple (*Acer circinatum*), maple (*Acer macrophyllum*), alder (*Alnus oregona*), cottonwood (*Populus trichocarpa*), dogwood (*Cornus Nuttallii*), thimble berry (*Rubus parviflorus*), salmon berry (*R. spectabilis*), raspberry (*R. leucodermis*), red elderberry (*Sambucus callicarpa*), red huckleberry (*Vaccinium parvifolium*), salal (*Gaultheria shallon*), Oregon grape (*Berberis nervosa*), fireweed (*Epilobium spicatum*), bracken fern (*Pteridium*), blue huckleberry (*Vaccinium ovalifolium*) and devil's club (*Echinopanax horridum*).

Of the plants of the region, the most conspicuous are the forest trees, which here reach gigantic proportions. Principal among these are fir, spruce, hemlock and cedar ranging from 200 to 400 feet in height, 80 feet clear of limbs, and from 10 to 13 feet in diameter, or more (the cedars ranging from 30 to even 50 feet in some instances). Intermingled with these trees is a profusion of shrubbery so dense in the coast districts that it is difficult to traverse the region. The estimated timber aggregates more than 70,000,000 M. feet B.M., or enough timber to supply the entire United States's demand for more than two years.

The plants so far identified in the peninsula number 689.

Twin Hybrids in Œnothera, with a Suggestion concerning their Explanation: R. R. Gates.

A large number of crosses were made, confirming in general the type of behavior in *Œnothera* called by de Vries twin hybrids, and adding new crosses which have not previously been made. When a member of the *Onagra* group of species of *Œnothera* is pollinated by *O. Lamarckiana* or one of its mutants, two types are produced known as *læta* and *velutina*, the former having broad and smooth leaves, the latter narrow, furrow-shaped and hairy leaves. These types resemble each other in the different crosses, and both usually breed true. There is a similar dimorphism in cultures of *O. lævifolia*, broad-leaved and narrow-leaved types occurring. In cultures of forms which probably belong to *O. muricata* (having smaller flowers than *O. biennis*), from wild seeds collected in Nova Scotia, at St. John, N. B., and at Winnipeg, a similar dimorphism is found to occur, *i. e.*, broad-leaved and narrow-leaved types, although the races do not all agree in other particulars. The Winnipeg plants came from seeds of one individual. There is therefore a marked dimorphism of some of the forms in the wild condition, and this may account for the occurrence of similar twin types in crosses in which *O. biennis* is the female parent, the condition being transmitted in the eggs, but not usually through the pollen.

The Sand-dune Flora of Iowa: B. Shimek.

A discussion of the distribution and the physiographic features of the limited dune areas of the state is given. The flora of the sand dunes is presented and the fact is brought out that while a limited number of species may be considered as characteristic of the dunes, the greater part of the flora is identical with that of the drier prairies.

On the Relation of the Living Cells to Transpiration and Sap-flow in Cyperus: James Bertram Overton.

Experiments in which cut stems of *Cyperus* are placed in water show that withering occurs sooner than when a certain portion, not to exceed 20 cm., has been killed with steam and the killed stems left in connection with the roots. When 20 cm. of the stem are killed with steam the leaves wither in about eight days, or in about the same time as control plants. It has been found that the longer the portion killed by steam the sooner the leaves above wither and dry. When 25–30 cm. of the stem are killed with steam, the leaves wither in three to five days, no matter how long the section killed with steam may be. The leaves on steamed stems never wither quite so quickly

as those on stems cut and placed in water, but under the same conditions of light, temperature and air moisture. In this plant sufficient water to keep the leaves turgid for three to eighteen days will rise through a stem 15–60 cm. high, with a section 5–60 cm. long killed with steam. Experiments show that a certain amount of water is raised through the steamed portions, but that it gradually diminishes in quantity from day to day, until the leaves become air dry. The diminished water supply is partly due to a partial blocking of the vessels with a gum-like substance, which probably owes its origin to the disorganization of the contents of the sieve tubes caused by heating the stems. The withering of the leaves above the steamed portion is probably caused by the action of deleterious substances introduced into them from the dead cells more than from lack of water. The poisonous substances are probably disorganization products caused by steaming the stems. The withering leaves above a steamed portion of the stem show all of the symptoms of dying, namely, rapid loss of water directly after treatment, then a more uniform loss, rounding up and discoloration of the chloroplasts and contraction of the protoplasts. The leaves apparently die, not so much from lack of water supply, as on account of the death of the cells from other causes. It is evident from experiments that the steaming method of killing portions of the stems is not a satisfactory one in order to settle the question of the relation of the living cells to sap-flow. Other methods have been used. Killing a portion of the stem by applying wax heated to 110° C. causes less apparent disorganization of the cells of the stems, less injury to the leaves above and does not cause a marked immediate decrease in the amount of transpiration.

An Undescribed Type of Elodea Flower: ROBERT BRADFORD WYLIE.

An unusual (and apparently undescribed) type of staminate flower was collected by the writer from East Okoboji Lake, Iowa, during the summers of 1909 and 1910. In this strain, which occurs abundantly in the locality, the axis of the staminate flower elongates rapidly at maturity, pushes out of the spathe and carries the pollen-bearing flower to the surface of the water, where it opens still attached to the plant. The degree of elongation may be as great as in the pistillate flower. While the general appearance of the two flowers is similar, and the habits of reaching the surface of the water are biologically alike, the parts concerned are not homologous. The elongated portion of the staminate flower is the axis below the floral parts, while that of the pistillate flower is the complex above the ovary in epigynous flowers called the "floral tube." In the opinion of the writer the form deserves specific rank, and the name *Philotria Iowensis* (*Elodea Iowensis*) is proposed.

The Flora of a Saline Lake: M. A. BRANNON.

This report is based upon a study of Devil's Lake, situated in Benson and Ramsey counties, North Dakota. It is a saline lake in the lowest portion of an inland drainage basin comprising about 4,000 square miles. The lake has lowered about 14 feet within 27 years with the attendant results of receding shore line, separation of the former lake into divisions and an increase in the salinity of the water.

Waves and the longitudinal and vertical currents cause thorough and rapid distribution of the phyto-plankton in which representatives of the Myrophyceæ predominate.

Ruppia maritima is the only spermatophyte found in Devil's Lake. It grows in profusion on submerged terraces along shores protected by high land terraces.

Enteromorpha prolifera, various species of *Cladophora*, and some of the Protococcales are the only Clorophyceæ found in this saline lake.

A study of ecological factors has been conducted with reference to pulsation in plant multiplication and in connection with inhibition of plants growing in adjacent bodies of sweet water.

Nodularia spumigens var. *litoria* gave the following record: May 29, 1910, there were three to five per cubic centimeter, August 18 there were several hundred filaments per cubic centimeter and on November 1 only two to three per cubic centimeter.

This pulsation was believed to be caused largely by the increased heat. The temperature readings on May 29 were 14° C., August 18 20° C. and November 1 11° C. The maximum portion of the curve was coincident with increased light action and increased wave and current action of the lake.

Spirogyra and *Chara* were used in the inhibition experiments and the results indicate that loss of turgidity when immersed in saline solutions was largely responsible for the non-existence of these and other forms in Devil's Lake. *Enteromorpha* and *Cladophora* are capable of standing ten to thirteen per cent. salt solutions, according to Oltmanns, hence these forms are not inhibited

from Devil's Lake but are present in great quantities. Detailed physical and chemical experiments await further investigations, but present information does not indicate that the toxic action of salts is responsible for the Devil's Lake inhibition of plant forms growing in bodies of sweet water adjacent to Devil's Lake.

Nuclear Phenomena in the Basidium and in the Germinating Spores of Dacrymyces and Tremella: E. M. Gilbert.

The discovery of the fusion of two nuclei in the basidium and the further fact that the cells from which the basidia arise are binucleate, has made it of vital interest to discover the origin of this binucleate condition. The writer finds that the spores of certain species of *Dacrymyces* and *Exidia* are uninucleate and become in germination, successively two, four and eight celled, each cell being uninucleate. Germ tubes are then developed and a mycelium formed, the cells of which have a single nucleus. The binucleate condition does not then arise at the germination of the spore or in the young mycelium. Dangeard, Perrot and Maire find that the subhymenial cells of various forms are binucleate. The writer finds a nuclear fusion in the young basidia of *Exidia albida* and *Dacrymyces* sp. The double division of the fusion nucleus in species of *Exidia* and *Tremella* studied, suggests, in many of its features, that chromosome reduction occurs at this stage. Synapsis and diakinesis are well marked stages. The two spored basidia of *Dacrymyces* as noted by Juel and Dangeard raise an interesting question as to the method of reduction in this form.

The Organization of the Chromosomes in Carex: A. B. Stout.

The visible structures in the resting nuclei in the root tip of *Carex aquatilis* and their behavior throughout mitosis make it plain that here the chromosomes are permanent individuals which can be identified not only in resting nuclei, but throughout the entire process of nuclear and cell division, except for a short time during the diaster stage when they are closely massed together.

The chromosomes are also arranged in a definite serial place relationship which is preserved throughout the late prophases and the equatorial plate stage. There is thus maintained throughout all stages of division a definite relative position of the chromosomes.

The spheroidal shape of the chromosomes is quite constant and uniform. There is, however, marked growth in their volume during early prophases until they reach their maximum size, which varies from 0.3 μ to 0.4 μ in diameter. This rather constant spheroidal shape facilitates the identification of the individual chromosomes throughout the various stages. At one stage in the late prophases the chain of chromosomes is tightly coiled about the nucleole.

This behavior of the chromosomes in *Carex* gives positive evidence in support of the view that chromosomes are permanent individuals with a definite and permanent relative arrangement in the nucleus.

The following papers were read by title:

The Relation of Aspergillus niger, Penicillium digitatum and other Organisms to Tannic Acid Fermentation: Lewis Knudson.

Some Problems in the Breeding of Sugar Beets: C. O. Townsend.

The Oxygen Minimum and the Germination of Xanthium Seeds: Charles Albert Shull.

Evaporation Studies in the Sand Dune Plant-associations of Lake Michigan and in the Beech Forest: George D. Fuller.

Studies of Castilla Seedlings: Pehr Olsson-Seffer.

Some Experiments on the Colors of the California Poppy: Pehr Olsson-Seffer.

Some Physiological Conditions in the Culture of Spirogyra: W. D. Hoyt.

On the Character of the Resin-tissue of the Araucarinæ and the Podocarpineæ: R. B. Thomson.

The Antheridia of the Laboulbeniaceæ: J. H. Faull.

Homothallic Conjugation in Rhizopus: Florence A. McCormick.

Henry C. Cowles
The University of Chicago

THE AMERICAN SOCIETY OF ZOOLOGISTS CENTRAL BRANCH

The annual meeting of the American Society of Zoologists, Central Branch, was held in conjunction with Section F of the American Association for the Advancement of Science in Pillsbury Hall of the University of Minnesota, Minneapolis, Minn., on December 28, 29 and 30, 1910, Professor C. E. McClung, of the University of Kansas, presiding.

The committee on nomenclature appointed at the Iowa City meeting reported that it was making progress in the formulation of a plan

whereby the various zoological organizations of America can unite in an effort to influence the International Commission on Nomenclature in the direction of securing greater flexibility in the interpretation of its own rules. The committee was given power to perpetuate itself.

The chair was authorized to appoint a committee whose function it shall be to recommend to the society plans for an agreement between its members regarding the form and manner of presenting papers for publication. Such plans shall have for their purpose the aiding of other investigators in arriving at an understanding of the methods and conclusions of writers with the least possible expenditure of time and effort.

Officers for the ensuing year were chosen as follows:

President—George Lefevre, University of Missouri.

Vice-president—R. H. Walcott, University of Nebraska.

Secretary-Treasurer—H. V. Neal, Knox College.

Executive Committee—H. B. Ward, University of Illinois (for three years); Chancey Juday, University of Wisconsin; H. W. Norris, Grinnell College.

The following, having received the votes of a majority of the executive committees of both branches, were elected to membership in the Central Branch: Dr. G. W. Tannreuther, University of Missouri; Dr. A. G. Ruthven, University of Michigan; Dr. R. C. Mullenix, Yankton College; Mr. H. Walton Clark, Bureau of Fisheries, Fairport, Iowa.

The following are titles and abstracts of papers presented at the meeting:

Organ Inversion in Trematodes: F. D. BARKER, University of Nebraska.

Situs inversus viscerum in varying degrees has long been known to occur in man. This deviation from the normal position of organs also occurs in a number of animals such as the tadpoles, flatfishes and molluscs. Variation in the position of the genital organs or *sexual amphitypie* is very common in the trematodes. From the examination of original specimens and the literature I have found this variation occurs in at least 26 different species, embracing 11 different genera of distomes and one genus of monostomes. The percentage of *sexual amphitypie* varies from 3 per cent. in some species to 50 per cent. in others. The degree of transposition of organs varies from the transposition of a single organ to that of six organs. In many cases other organs than the sexual organs are transposed, in which cases the term *situs inversus* is more applicable. Where only one or two organs are transposed this should be designated as *partial sexual amphitypie.*

A number of theories as to the cause of *situs inversus* has been advanced, among which are "the preponderance of the omphalo-mesenteric vein," "the persistence of the left venous trunks," "discontinuous substantive variation," "a condition essential to the existence of the organism," "inversion through sympathy."

Experimental work on incompletely separated blastomeres of the frog, sea-urchin, mollusc, etc., shows that such blastomeres give rise to twin embryos, one of which is a "mirror image" of the other. This suggests the possibility that "mirror images" or *sexual amphitypie* in the trematodes may be due to the development of twin trematodes which have arisen from completely separated portions of the "germ balls" in the sporocyst or redia stages.

Fuller account to be published later; place undetermined.

Gametogenesis in Tænia serrata: R. T. YOUNG, University of North Dakota.

Testes and ovaries arise from undifferentiated parenchyma cells. Oogonia and spermatogonia are similar in structure and appear to arise similarly. No mitoses are found in the early stages of development of these cells. Amitoses, while present, are too infrequent to account for the multiplication of the primitive sex cells, and it is probable, although not certainly demonstrable as yet, that increase is partly due to the development of nuclei either de novo or from chromidial extrusions from preexistent nuclei.

The spermatocytes of the first order arise from the spermatogonia by an enlargement of the nucleus and the formation of a skein from its reticulum. The spermatocytes fuse to form cytophores with subsequent breaking up of the skeins and commingling of the skein remnants with the cytoplasm of the latter. The secondary spermatocytes arise in the cytophores either *de novo* or from the skein remnants of the first spermatocytes. The spermatozoa are formed directly from the cytoplasm of the cytophores. In oogenesis skeins are similarly formed subsequent to the growth period and similarly degenerate without the occurrence of later stages of mitosis at this time. As the ova are leaving the ovaries or after reaching the uterus an abortive maturation mitosis occurs, without however the appearance of polar bodies; the cell or cells which have been

occasionally interpreted as such, being yolk cells attached to the ova during or after their passage to the uterus. These observations support the view previously advanced that cytological processes in cestodes are degenerating in correspondence with the general degenerate character of these worms.

Full account to be published elsewhere.

The Biology of the Sand-Hill Region of Nebraska: Robert H. Wolcott, University of Nebraska.

In Science for May 19, 1905, appeared a statement in regard to a faunal survey of this region which had been already inaugurated. Soon after the publication of this statement, conditions arose which interfered with the further prosecution of this work, and in the five years which have intervened only occasional short trips to the region have been made. During the past season, however, work was actively resumed by the collecting of water samples from the different lakes and the collection of additional data and specimens bearing on the topography and fauna of the lake region. A preliminary chemical examination of these water samples shows that the lakes vary in strength of alkali, expressed in terms of CO_3 and HCO_3 ions, from .06 of a gram per liter to 1.61 grams per liter—a difference of more than 25 times. The most highly alkaline of these lakes is not as alkaline as many other lakes which have been investigated in the far west, but the close proximity to one another, the exact similarity in every other respect than alkali content, and the fact that the alkalinity in the strongest of these lakes surpasses a percentage which apparently most of the forms present in the freshest lakes can not resist, seem to make it probable that the results of a careful qualitative analysis of the life of the different lakes will yield very interesting results. Arrangements have been perfected whereby a party is to be maintained in the region throughout the coming summer, and it is expected that in this way a sufficient amount of material can be gathered to allow of the formal presentation of results, at least so far as certain phases of the work are concerned.

The Olfactory Organs and the Sense of Smell in Birds: R. M. Strong, the University of Chicago.

A report was given of a comparative study of the organs of smell in various groups of birds. Results of experimental studies of the olfactory sense in ring-doves were also described. Evidence was obtained in this work that at least many birds probably have an olfactory sense. It is not likely, however, that the sense of smell is ever very keen in birds. A full account has been prepared for publication elsewhere.

Results of Breeding Experiments with Ring-Doves: R. M. Strong, the University of Chicago.

Crossing experiments with white and blond ring-doves were carried on during a period of five years. In the first generation, the hybrids resembled one parent or the other in equal numbers. The blond hybrids were mostly males and the white hybrids were all females. The original stock was found to breed true, but the blond hybrids behaved as heterozygotes. A full account of the results obtained will appear later.

The Cranial Nerves of Siren lacertina: H. W. Norris, Grinnell College.

The olfactory nerve is double. Anastomoses between the fifth and seventh nerves; general cutaneous fibers from the fifth and lateral line fibers from the seventh form a supra-orbital trunk, and similar fibers form an infra-orbital trunk; from the latter general cutaneous and lateral line fibers unite with a branch of the ophthalmicus profundus to form a nerve that sends its lateral line fibers to innervate neuromasts at the end of the snout and its general cutaneous component to form an anastomosis with the ramus palatinus; between the alveolaris VII. and the mandibularis V. the characteristic anastomosis occurs only to the extent of a slight contact between the two nerves. From the dorsal lateral line ganglion of the seventh nerve a nerve passes posteriorly to anastomose with the rami supratemporalis and auricularis X., suggestive of the condition in the Cyclostomata. The rami alveolaris and palatinus arise by a common trunk from which is given off a so-called "posterior palatine" that connects with the ramus pretrematicus IX. forming Jacobson's commissure. The ramus communicans carries general cutaneous fibers only, from the tenth to the seventh nerve. Pretrematic rami of five branchial nerves are found. The ramus intestinalis recurrens X. is entirely motor, its usual sensory component having separated to form a distinct trunk. The hypoglossal nerve is formed from branches of the first and second spinal nerves. Full account to appear in Vol. 17, *Proceedings of the Iowa Academy of Science,* 1910.

The Innervation of the Lateral Line Organs in Amphiuma and Siren: H. W. Norris, Grinnell College.

Kingsbury's classification and grouping of the lateral line organs in amphibia is found to correspond in a general way to their innervation in *Amphiuma* and *Siren*, but it is evident that the external distribution of neuromasts is no exact indication of their innervation. Much overlapping of groups occurs, and there appears to have taken place a considerable degree of migration of neuromasts from their points of origin. The occipital group of neuromasts is innervated not by the lateral line nerve of the trunk, as Kingsbury supposed, but by the rami supratemporalis and auricularis X. The ramus lateralis VII. in *Amphiuma*, contrary to the earlier opinion of the writer and of Drüner, has no connection with neuromasts. The neuromasts in *Siren* have a much less typical arrangement than in *Amphiuma*. Full account to appear in *Proceedings of the Iowa Academy of Science*, Vol. 18, 1911, under the heading "The Lateral Line Organs of the Urodele Amphibians: Distribution and Innervation."

A Review of Recent Work on the Development of the Sympathetic Nervous System: ALBERT KUNTZ, University of Iowa.

Poulton's Theory of the Origin of Mimicry in Certain Butterflies: J. F. ABBOTT, Washington University.

A biometric study of the variation of the color pattern of butterflies of the two species of *Limenitis, arthemis* and *archippus*, captured in the same region in New York State fails to confirm Poulton's theory that the latter form has originated from the former by an expansion and migration through the agency of selection, of color patches existing in the ancestral type (*arthemis*). The selection hypothesis by itself would thus seem inadequate to explain the origin of the phenomenon.

Comparison of the Arrangement of Eggs in Nests of Japyx sp. and Scutigerella immaculata: STEPHEN R. WILLIAMS, Miami University.

A photograph of two specimens of *Japyx* sp. guarding their eggs was snown. The two egg-masses were placed, each in a cavity in decayed wood, in such a way that only a very few eggs were in contact with the substratum. The rest were heaped upon these and touched nothing else in the cavity.

The attending individuals died within twenty-four hours and the eggs never hatched, being attacked by fungus.

Precisely the same arrangement of the eggs is seen in *Scutigerella immaculata*, which occupies the same habitat. The eggs are placed in a heap, few eggs only touching the moist decayed wood of the substratum and the rest above and around these. The female remains with the eggs to keep off fungi and animal parasites and no masses of eggs unattended by the female have hatched under laboratory conditions.

When *Scutigerella* in the laboratory is unable to find a sufficiently secluded place to deposit the eggs they will be laid singly here and there. In every case, however, the single egg is fastened to the substratum as if in preparation for heaping others about it.

Besides the well-known outward resemblances between *Japyx* and the Symphyla—the shape of the antennæ, the shape of the body, the presence of pairs of rudimentary legs on the segments of the abdomen—can these similar nesting habits not be considered as an additional indication of relationship?

The Vitalism-materialism Controversy: Can it be Ended? (vice-presidential address): W. E. RITTER, University of California.

On the Transition from Parthogenesis to Gamogenesis in Aphids: S. J. HUNTER, University of Kansas.

Observations on the conditions attending the appearance of the sexes in the aphid, *Toxoptera graminum*, now made continuously through four years, show that time of occurrence of sexes and attendant behavior of the agamic and intermediate forms continue as presented in a paper a year ago before the eastern branch.[1]

The problem of this year, beginning January last, was the addition of the woolly aphis to be studied under normal conditions, and an attempt to determine what bearing, if any, modifications in food supply might have on the *Toxoptera graminum*. A duplicate series of experiments in charge of two careful observers were established last January under the following conditions in the laboratory. Wheat was germinated in three-inch pots and each treated continuously with—instead of water—solutions of a number of salts—seventeen in all, respectively. New pots of wheat, similarly treated, replaced those in which wheat succumbed to treatment.

Daily observations and records were made on each one of these experiments throughout the

[1] SCIENCE, N. S., Vol. XXXI., p. 476, March 25, 1910.

entire year, and comparisons made with the stock growing in the laboratory. The wheat clearly showed the effect of the different treatments, but aphids did not manifest any significant change. When the sexual and intermediate forms began to appear on the regular stock in October they likewise began to appear on these experimental pots.

In the woolly aphis the agamic forms were wingless throughout the entire summer season. The first winged forms appeared September 19, and ceased to appear on December 6. The offspring of these winged forms are the true sexes. The first of these to appear was on December 25. These true sexes are wingless and in accordance with the observations of Von Baehr each female produces but one egg. All colonies do not produce winged forms and hence all colonies do not produce sexual forms. All winged forms of the woolly aphis do not produce offspring. Out of a series of nineteen isolated winged forms only eleven reproduced and these eleven brought forth twenty-seven young composed of twenty-one males and six females.

Thus far it appears difficult to correlate and establish external conditions which would appear to have a direct bearing on the transition from parthogenesis to gamogenesis in aphids.

In the two forms studied the sexes appear in the fall of the year and may be spoken of as seasonal. This is true also for a very large number of aphids whose behavior in this respect has been recorded by others. This naturally leads to a careful analysis of the conditions obtained at this period of the year. It is our purpose now to continue these studies throughout the next year, dealing chiefly with the questions of temperature and light.

On a Case of Parasitic Thoracopagus in a Frog: George Wagner, University of Wisconsin.

An instance of a frog having three extra legs extending from an irregularly shaped bone overlying the sternum; the case was interpreted as representing what by students of teratology is known as an epigastrius (Schwalbe), or a parasitic epigastrius (Adami). The case is believed to be the first of its kind reported in an amphibian. A full account of it will be published later in the *Biological Bulletin.*

The Pomace Fly Bred in the Dark for 67 Generations: Fernandus Payne, University of Indiana.

The Proposed Laysan Island Expedition and Exhibit: C. C. Nutting, University of Iowa.

The Origin of the Sex-cells in Necturus: Bennet M. Allen, University of Wisconsin.

The sex-cells of this amphibian arise from that portion of the mesoderm which lies between the future myotome and the future lateral plate. This anlage was recognized as early in development as an early medullary plate stage, owing to the fact that it is noticeably thicker than the lateral plate region lateral to it, and that it is at the same time marked off from the anlage of the mesoblastic somites by a constriction that indicates the first point of division of the mesodermal sheet.

The mesodermal cells show very slight differences at this stage, being equally filled with yolk, and having nuclei in which I, thus far, have been unable to distinguish constant and important differences, nor has it been possible thus far to differentiate them from the nuclei of the endoderm. It is just possible that further work may enable me to distinguish them in this and in earlier stages, by the use of special staining methods.

While the outlines of this sex-cell mass are vague at the outset, they become very clearly defined in later stages, when, first the myotome, and then the lateral plate tissues begin to use up their yolk material, while the sex-cells remain unchanged and do not divide. It then becomes evident that the sex-cell anlagen are continuous in the greater part of their extent, being somewhat interrupted only at their cranial and caudal ends.

At the stage with which this account begins, the Wolffian ducts have not yet been formed. So soon as they make their appearance, however, they lie immediately above and slightly medial to the sex-cell anlagen. In still later stages, the latter are seen to shift toward the median line. This movement accompanies the growth of the lateral plates and appears to be caused by it. The sex-cell anlagen finally meet in the median line and the mesentery forms beneath them. They then migrate laterally to the anlagen of the sex-glands.

While it will be seen that this account is quite in agreement with Dustin's account of the origin of the sex-cells in *Triton,* and consequently at variance with the process described in my paper on the origin of the sex-cells in *Rana pipiens,* I have nothing whatever to retract from the observations and conclusions expressed in that paper. Repeated study of my old preparations and of many new ones have confirmed their accu-

racy. Furthermore, the papers of King on *Bufo lentiginosus* and of Kuschakewitch on *Rana esculenta* have confirmed my work on *Rana pipiens*. While Dustin strikes a discordant note in his account of the origin of the sex-cells of *Rana fusca* and *Bufo vulgaris*, it may not be wide of the mark to tentatively advance the view that the sex-cells arise in the Urodeles from that portion of the mesoderm between the anlage of the mesoblastic somites and lateral plate, while in the Anurans they arise from that part of the endoderm that forms the median portion of the roof of the archenteron. This is not inconsistent with the conception of the sex-cells which is being more and more firmly established, namely, that they are cells preserved from early stages in an undifferentiated condition and that they are capable of considerable migration along radically different paths. There must, as a matter of course, be a more or less close correspondence in these migration paths in closely allied forms, but radical differences might be expected in such fundamentally different groups as the Urodeles and the Anurans.

Anatomical Illustration before Vesalius (with illustrations from original sources): W. A. LOCY, Northwestern University.

On the Distribution in the United States and some Points in the Habits of Clinostomum marginatum: HENRY LESLIE OSBORN, Hamline University.

This trematode was first recorded in Europe by Rudolphi in 1809 under the name *Distomum marginatum*. The following summary shows the records of its occurrence in this country with date, writer, name, host and infected part, and locality: 1856, Leidy, *Clinostomum gracile, Esox,* intestine, Delaware River; 1877, Leidy, *Distomum galactosomum, Roccus lineatus,* Philadelphia; 1879, Wright, *Distomum gracile, Perca flavescens,* branchiostegal membranes, Toronto; 1879, Wright, *Distomum heterostomum, Botaurus minor,* mouth, Toronto; 1885, Looss, *Distomum reticulatum,* silurid fish encysted in muscle tissue, Porto Rico; 1895, MacCallum, *Distomum gracile,* frog, encysted in pectoral muscle, Toronto; 1897, MacCallum, *Distomum heterostomum, Ardea herodias,* mouth, Toronto; 1898, *Distomum gracile, Eupomotis pallidus,* pectoral fin and roof of mouth, Kansas City, Mo.; 1901, Osborn, *Clinostomum marginatum, Micropterus dolomieu,* encysted in muscle, Nebish, Mich.; 1901, Osborn, *Clinostomum marginatum, Ardea herodias,* throat, Nebish, Mich.; 1903, *Clinostomum marginatum, Rana virescens,* encysted in cœlom wall and subcutaneous lymph spaces, Saint Paul, Minn.; 1903, Young, *Clinostomum marginatum, Micropterus dolomieu,* encysted in branchiostegal membranes and muscle, Troy, Ohio; 1904, Stafford, *Clinostomum gracile, Perca flavescens,* gills, Montreal. Its distribution is thus shown to be very wide, as indicated by the names Philadelphia, Troy (Ohio), Kansas City, Saint Paul, Nebish, Toronto and Montreal. And yet we do not know its primary host, the worm being virtually completely developed when found in the fish and frog. It is a trematode of economic importance, since it infects the edible portion of one of our principal game fishes, though it is presumably not strictly harmful to man. It is evidently very widely spread in northern and eastern United States and may be expected to be found outside the limits already noted as soon as search is made. The habits of the worm were studied in the forms encysted in the bass. The cyst is a perversion of the endomysial connective tissue and is wholly contributed by the host. The worm in the cyst is bent twice on itself, the ventral surface being turned toward the inner surface of the cyst whose cavity is completely filled by the worm. Immediately on escaping from the cyst the worm is very active indeed, its movements, besides many random and irregular ones, falling under two types: a retraction of the anterior end, producing a club-shaped front region possibly related with adhesion, and a thinning and flattening of the body such that its ventral surface becomes somewhat concave and the margins of the body assume the appearance of lateral fins. Neither of these two body forms were made practical use of by the worm, the body merely taking on the shape momentarily and then relaxing back at once into the resting form.

The worms in the frog were studied at St. Paul. They are not so much found in the muscle of the frog, their usual location in the fish, as in the cœlomic wall where the cysts lie, not in the muscular tissue, but between it and the peritoneum. The cysts, too, are very much larger than those in the fish and the worm is bent double within, the ventral surface being external. The cysts are similar in structure to those in the fish, being made up of fibrous tissue and supplied with a distinct capillary network.

It is planned to publish this paper in the *Biological Bulletin.*

The Transmission of Trypanosoma lewisi by Rat Fleas (Ceratophyllus sp. and Pulex sp.), with

Short Descriptions of Three New Herpetomonads: L. D. Swingle, Nebraska Wesleyan University.

The rat trypanosoma passes through a cycle of development in the digestive tract of rat fleas. After it is taken into the flea's stomach, it soon passes backwards into the intestine. The nucleus moves toward the posterior end, the blepharoplast toward the anterior end of the body and the undulating membrane is lost, so that a Crithidia results. Some of the individuals agglutinate by their flagellar ends and eventually form cysts. Others, by rounding off at the anterior ends, form cysts directly. In these the posterior end containing nucleus and blepharoplast remains very pointed. Forms resembling the "latent bodies" of *T. lewisi* were found in the crushed heads of fleas.

A case which might reasonably be interpreted as a conjugation of male and female forms was found.

The fleas harbor a natural flagellate, *Herpetomonas pattoni* n. sp. Two new herpetomonads are described: they are *Herpetomonas calliphoræ* n. sp. from *Calliphora coloradensis* and *Herpetomonas lineata* n. sp. from *Sarcophaga sarraceniæ*.

To be published in the *Journal of Infectious Diseases*.

The Nature and Origin of the Fish-fauna of the Guiana Plateau: C. H. Eigenmann, University of Indiana.

Color Inheritance in Tumbler Pigeons: Leon J. Cole, University of Wisconsin.

From black tumbler pigeons crossed with red were produced in F_1 27 offspring, which were all black, with, however, reddish tips (often very conspicuous) on the feathers prior to the first molt. From these birds bred *inter se* segregation was obtained in F_2, which comprised 71 birds, of which 45 were black and 26 red. No explanation was offered for the departure from the Mendelian ratio. Furthermore, practically all these blacks in F_2 have reddish tips on the first feathers. This point was discussed in its relation to melanin oxidation and Mendelian inheritance.

Some results from other crosses were given.

Sex Ratio and other Reproduction Statistics in Tumbler Pigeons: Leon J. Cole, University of Wisconsin.

Statistics presented showed that of the two eggs laid by pigeons at a sitting each produces approximately an equal number of males and females, and that the chances are equal that the two eggs will produce birds of the same sex or birds of opposite sex. This corrects the popular notion that the two eggs of a sitting produce a pair of young (a male and a female) and that the first one laid usually, if not always, produces a male.

In 62 per cent. of 101 cases of tumblers the interval between the laying of the first egg and the second was 44 or 45 hours. Nevertheless, in a large percentage of cases the eggs hatch at approximately the same time.

The normal period of incubation is seventeen days, but birds allowed to sit on eggs which do not hatch will sometimes incubate up to thirty days.

(This paper and the preceding are based on experiments conducted at the Rhode Island Agricultural Experiment Station, the results of which will shortly be published in full by the station.)

A Note on the Metamorphosis of Lampsilis lævissimus: Robert E. Coker and Thaddeus Surber, Fairport Biological Station.

The glochidium of *Lampsilis lævissimus* is of the "axe-head" form similar to that of *L. alatus*, but without the hooks characteristic of the latter. The same form of glochidium is seen in *L. capax*, although in the shape of adult, *capax* is at an opposite extreme from *lævissimus*. Nevertheless, in certain significant taxonomic characters *lævissimus* and *capax* show agreement in the adult stage.

A few specimens of mussels in the stage of parasitism which show glochidial shells of the *lævissimus* form have been observed. These young mussels show a notable increase in size and a striking change of form as compared with the glochidial stage. It is not known that such marked changes occur in other species during the period of parasitism.

An Alpheus with Two Equal "Snapping" Chelæ: Charles Zeleny, University of Illinois.

Some Data concerning Dibothriocephalus latus in America, with Report of a Second Case of Infection Acquired in the United States: W. S. Nickerson, University of Minnesota.

I have collected from physicians reports of the occurrence of the fish tape-worm (*Dibothriocephalus latus*) of man in 65 cases, 51 of which were in Minnesota. But six of these have been previously mentioned in literature. The hosts in two cases were Swedes, in one a Japanese, in two native born, and the others with few if any exceptions were Finns.

I have also to report a second case of *Dibo-*

thriocephalus infection acquired in this country. It occurred in a woman who was born and has always lived in Hennepin County, Minn., never having been out of the state except once for a visit to North Dakota. While there she ate dried and smoked fish (otherwise uncooked) and it was soon after her return home that she experienced symptoms attributable to the tape-worm. The infection must therefore have occurred in America and from the eating of American fish.

Paragonimus in a Cat in Minneapolis: W. S. NICKERSON, University of Minnesota.

I wish to put on record the occurrence of *Paragonimus Kellicotti* in the lung of a cat from the grounds of the University of Minnesota. Three specimens were obtained.

An American Intermediate Host for Hymenolepis diminuta: W. S. NICKERSON, University of Minnesota.

The common tape-worm of the rat, *Hymenolepis diminuta,* is also an occasional human parasite, some fourteen cases having been reported. It has been shown in Europe that its cercocystis stage may be passed in several insects, the meal moth and its larva (*Asopia*), the earwig (*Anisolabis*), and beetles (*Akis* and *Scaurus*), *Asopia* being the form that commonly serves as intermediate host. In America an intermediate host has not been observed and attempts at experimental infection of our American meal-worms have not been successful.

A case of infection of a child in Minnesota by *Hymenolepis diminuta* has come to my attention in which the circumstances suggested strongly that the diplopod *Julus* had been the intermediate host from which the child had become infected. Acting upon this hint I fed fragments of *Hymenolopis diminuta* to young diplopods, supposed at the time to be young julids. Some of these were found subsequently to be full of cercocystides agreeing fully with those figured by Grassi and Rovelli and which they demonstrated experimentally to be the young of *Hymenolepis diminuta.* Later I learned that my diplopods were *Fontaria virginia* Bollman of the family Polydermidæ.

In an attempt to repeat the experiment, using *Julus* instead of *Fontaria,* I was able to obtain but a single specimen of *Hymenolepis diminuta* with but few proglottides having ripe ova. In one of the specimens of *Julus* to which the proglottides were fed a few specimens of cerocystides were subsequently found which were of the same sort as those previously obtained from *Fontaria.*

The rearing of the adult worm (Hymenolepides) from the larvæ by feeding experiments was rendered impossible in both cases by the fact that the infected condition of the myriapods was not discovered until they were already dead. In view, however, of their complete agreement with the descriptions and figures given by Grassi and Rovelli of the larvæ of *Hymenolepis* and the way in which they were obtained there can be no doubt as to their identity.

These experiments show that at least two different genera belonging to the class Myriapoda may act as intermediate hosts for *Hymenolepis diminuta* in America. The intermediate hosts previously known in Europe are of the class Hexapoda.

Preliminary Account of the Early Development of Cirratulus grandis Verrill: JOHN W. SCOTT, Westport High School, Kansas City, Mo.

The common fringe-worm of the Atlantic coast, at Woods Hole, is found in muddy ooze around the roots of eel grass. It is easily excited to oviposition, but few eggs will fertilize if deposited before 10 P.M. Eggs deposited during the night may be fertilized the next morning. The first polar body comes off in 10 minutes, and the second in 17 minutes. A yolk lobe is formed, may be constricted off, but is always reabsorbed. Unequal cleavage occurs at 49 minutes. The second cleavage, 8 minutes later, results in a three-celled stage. The entoderm appears to be separated at the first cleavage. The entoderm cell remains long undivided, and gastrulation takes place by overgrowth of other cells. The trochophore is scarcely able to leave the bottom and is never pelagic. At 51 hours it settles on the ventral side and moves like a flatworm; a ventral band of cilia is used for locomotion. Septa develop and disappear with the one exception found in the adult. An introvert arises as an infolding of the body wall posterior to the mouth; later a common opening serves for both. The introvert is used at this stage, chiefly for locomotion. The larva was kept until 20 days old.

An Accessory Chromosome in the Opossum: H. E. JORDAN, University of Virginia.

The number of chromosomes in equatorial plates of dividing spermatogonial and interstitial cells equals seventeen. Plasmosome present in resting primary spermatocyte. This stains intensely black in iron-hæmotoxylin, but only faintly green in Auerbach's stain (= methyl green + acid fuchsin). Plasmosome can not be traced into later

stages, but during synapsis a dark-staining snarply contoured body (accessory chromosome) appears at point where the loops converge. This point is always next the conspicuous centrosphere lying just outside of the nuclear wall. Plasmosome believed to become accessory chromosome on basis of similarity of form, *i. e.*, bipartite character. In post-synaptic stages, while the autosomes are still only slightly chromatic, the deeply chromatic monosome (accessory chromosome) always lies close to point where centrosphere is located.

Equatorial plates of first maturation mitosis contain nine chromosomes (eight bivalent ordinary and one accessory chromosome). The accessory, both here and in earlier stages, appears bipartite, sometimes completely divided and separated. The accessory passes undivided to one pole slightly in advance of the eight univalent ordinary chromosomes, the opposite pole receiving only eight chromosomes. Two types of secondary spermatocytes are formed, one with a slightly chromatic nucleolus (=accessory), the other without. Equatorial plates of second maturation mitoses show five chromosomes (four pairs of the eight univalents of last mitosis + one accessory) and four cnromosomes, respectively. In late telophase the pairs are again resolved into nine and eight chromosomes, respectively. Dimorphism of spermatids—metamorphosis into spermatozoa and the presence of chromidial elements—were also considered.

This paper will be published in the *Journal of Morphology*.

The Formation of the Spermatophore in Arenicola and a Theory of the Alternation of Generations suggested by the Facts in the Case: Elliot R. Downing, Northern State Normal School, Marquette, Mich.

The spermatophore in *Arenicola cristata* arises as a result of the cleavage of a primary spermatogonium in a manner homologous with the cleavage of an egg in the same species. There is an invagination of certain spermatogonial macromeres and micromeres to form the nutritive cells which supply the developing spermatophore with food by their disintegration and absorption. These cells are homologues of the egg mesentomeres. The spermatophore is shed from the testis into the body fluid at an early stage, sometimes even before the cleavage of the spermatogonium has begun. Here the early spermatophore becomes a hollow mass of cells which later, by a false invagination, becomes gastrula-like. The false gastrula flattens out and becomes a saucer-shaped mass of spermatids. These develop within themselves the sperm.

The facts suggest that the spermatophore is an individual—the gametozoon which bears the gametes. The adult male is a sporozoon which develops the spores or primary spermatogonia.

The alternation of generations and reduction are independent phenomena, as is shown (1) by apogamy and apospory, (2) by the fact that among the protozoa and algæ reduction may occur before, during or after the conjugation of the gametes, that is, in either the sporo- or gametogeneration.

Reduction is an adjunct rather than a corollary of sexuality. If it were the latter, reduction should always occur in a definite relation to the sexual act, not before, during or after it.

The spermatophore must be suggestive of the primitive animal type just as the gametophyte suggests a thalline ancestry for plants. Perhaps the Volvocales come nearest, among living forms, the primitive form. In *Volvox* reduction has its animal position during gametogenesis.

If reduction occurred in the primitive forms before or during the fusion of the gametes the gameto- and sporo-generations would have the same number of chromosomes. This is the case in the gametozoon and sporozoon of *Arenicola*. Since all animals and many algæ have reduction in such a position the preponderance of evidence is that it had this position in the common animal and plant prototype. In plants, then, it has shifted from this primitive place toward the end of the sporophyte generation.

Aquatic Photography for Zoologists: Wm. Alanson Bryan, Honolulu, H. I.

The paper briefly explains and illustrates with lantern slides some of the essentials in the method and the apparatus used in securing photographs of aquatic objects for book and class-room illustration. The successive steps in evolving a method that resulted in securing the first aquatic motion pictures are explained.

The Discovery of Archigetes in America, with a Discussion of its Structures and Affinities: Henry B. Ward, University of Illinois.

Among the monozoic cestodes, often grouped as a separate class or subclass under the name Cestodaria, the Caryophyllæidæ stand closest to the merozoic cestodes, particularly to the Bothriocephalidæ. Neither of the genera previously known, *Caryophyllæus* or *Archigetes*, has been reported from this continent, although several

species are relatively common in Europe. During the past summer, a form belonging to this group was found in fish from the Illinois River at Havana. Its structure shows certain features which are common to both of the known genera, *Caryophyllæus* and *Archigetes*. It resembles the former in the absence of a caudal appendage and in the location chosen by the adult parasite, viz., the intestine of a fish, whereas, so far as known in Europe, *Archigetes* always possesses a tail and has been found only in the body cavity of tubificid worms. In general appearance and structure the American form resembles the European *Archigetes* very strongly. It has a scolex of fixed form with primitive suckers or phyllidia and also the musculature of *Archigetes*. The general arrangement of reproductive organs, especially the two rows of testes in the central field, and the genital pores, correspond also closely to conditions in *Archigetes*. Two alternative hypotheses present themselves: (1) the European forms may have a yet undiscovered adult stage in some vertebrate host and in that case the caudal appendage would be lost as in *Caryophyllæus* and in the form under discussion; (2) the American form described here may represent a higher stage of development. In the latter case the European form is either a degenerate type in which the intestinal stage has fallen out of the life history, leaving only a sexually mature larva parasitic in the body cavity, as *Amphilina* another cestodarian has been interpreted by Pintner; or the American form indicates the adaptation by which the invertebrate parasite has acquired a vertebrate host and includes in its life history two hosts, as is typical in cestodes generally. The full paper will be published elsewhere.

Notes on Extinct Amphibia: ROY L. MOODIE, University of Kansas.

Chromosome Individuality: C. E. MCCLUNG, University of Kansas.

The Histogenesis of the "Transient" (Rohon-Beard) Cells in Selachian Embryos: H. V. NEAL, Knox College.

The study of the histogenesis of the "transient" (Rohon-Beard) cells in selachian embryos confirms earlier conclusions based upon the study of the histogenesis of ventral nerves that the neuraxon process develops as an amœboid outflow of the neuroblast cell. The growth and histogenesis of the neuraxon process of the "transient" or "giant" cells of Rohon-Beard may be easily followed, since in reaching its peripheral termination the process grows into and through spaces devoid both of mesenchyma cells and of intercellular bridges or "plasmodesmata." Such spaces, however, are filled with a plasma containing a slight amount of coagulable substance which with some fixing reagents gives the plasma a vacuolated structure. The termination of the nerve fiber or neuraxon, as it penetrates these spaces, consists of many pseudopodia-like extensions. In some cases, as the neuraxon in its growth reaches the dorsal apex of the myotome, pseudopodial processes extend, some median and some lateral to the myotome. It seems to be a matter of chance whether in its further extension the neuraxon process shall grow median or whether it shall grow lateral to the myotome. Of a primary reticulum or "plasmodesma" connecting the neuroblast cell in the neural tube with its terminal organ there is not the slightest evidence. The experimental results of Harrison on amphibian embryos are fully corroborated by the evidence presented by the growth of the neuraxon processes of these "giant" cells.

Such facts obviously have an important bearing on the problem of the phylogeny of the vertebrate head, since they tend to disprove the assumption of earlier morphologists that nerve and muscle are inseparably connected and to make explicable the greatly modified metameric relations of the eye muscle nerves and possibly to give us the clue which may lead to the solution of the mystery of the chiasma of the trochlearis.

The Origin of the Rudiments of the Mesenteron in the Honey Bee: JAMES A. NELSON, Bureau of Entomology, Washington, D. C.

The anterior mesenteron rudiment of the honey bee arises at a period immediately after the appearance of the lateral folds, on the ventral surface of the egg near its anterior pole. It is at first nearly circular in outline, and sharply distinguished from the blastoderm by the deeper staining properties of its cells. At first it lies outside the area embraced by the lateral folds, but is later included in this area as the folds lengthen. Sections show that this mesenteron rudiment is produced by active proliferation of the cells of the blastoderm. After the union of the lateral folds this is detached from the blastoderm as a flat plate of cells which increases rapidly in extent, moves cephalad and soon covers the yolk at the anterior pole of the egg like a cap. The history of the posterior mesenteron rudiment is similar, but it is smaller, and first appears at the posterior pole of the egg. Later, after the rudiments of the appendages have ap-

peared, the stomodæal and proctodæal invaginations are formed at or near the places of formation of the mesenteron rudiments. The rudiments of the mesenteron at their inception are thus sharply marked off from the blastoderm of the middle plate (mesoderm) on the one hand, and the epithelium of the proctodæum and stomodæum (ectoderm) on the other. These observations are in close accord with those of Carrière and Bürger on *Chalicodoma*.

The so-called blastopore and the yolk plug described by Dickel (1904) for the honey bee have been observed; but the writer can not confirm this investigator's conclusions relative to these structures. The yolk plug, which Dickel thought connected with the formation of the mesenteron, was found in the same sagittal section with the true anterior mesenteron rudiment, the one on the dorsal, the other on the ventral surface of the egg, thus demonstrating that no close genetic relationship exists between them. The origin and fate of this so-called yolk plug is obscure, but it is a transitory structure, of very brief duration, possibly a vestigial organ.

Birds of the Olympic Peninsula: Albert B. Reagan, U. S. Indian Service.

The Olympic Peninsula, Washington, extends from Grays Harbor on the Pacific coast north to the Strait of Juan de Fuca and east to the "sound." So far as the habitation of birds is concerned, the region divides itself into three parts—the coast strip, the mountains and the islands off the coast.

The coastal strip ranges from twelve to thirty miles in width. The central, high section is a circular area forty miles in circumference in the east central part of the peninsula, ranging from 6,000 to 8,000 feet in height, with a declining ridge extending northwestward to Cape Flattery. The whole mainland area, except in the high mountain districts, is heavily forested and covered with a dense underbrush so that near the coast it approaches the jungle state. For this reason birds in this division are hard to find, as they can so easily seclude themselves; but at the beach line and in the island districts they are in evidence.

The land species generally met with are: northwestern crow (*Corvus caurinus*), northern raven (*C. corax principalis*), desert sparrow hawk (*Falco sparverius phalæna*), black cloud swift (*Cypseloides niger borealis*), American crossbill (*Loxia curvirostra minor*), Audubon warbler (*Dendroica audubon*), rough-winged swallow (*Selgidopteryx serripennis*), rufous hummer (*Selasphorus fufus*), rusty song sparrow (*Melospiza cinera morphna*), sooty song sparrow (*Passerella iliaca* (*fuliginosa*)), bald eagle (*Haliæetus leucocephalus*), black merlin (*Falco columbarius suckleyi*), Peale falcon (*Falco peregrinus pealei*), harlequin duck (*Histrionicus histrionicus*), ruddy turnstone (*Arenaria morienella*), Hudsonian curlew (*Numenius hudsonicus*), northern phalarope (*Phalaropus lobatus*), barn swallow (*Hirundo erythrogaster*), western winter wren (*Olbiorchilus hiemalis pacificus*), pectoral sandpiper (*Actodromas maculata*), western sandpiper (*Ereunetes occidentalis*), lutescent warbler (*Helminthophila celata lutescens*), russet-backed thrush (*Hylocichla ustulata*), yellow warbler (*Dendroica æstiva*), black turnstone (*Arenaria melanocephala*), semi-palated plover (*Ægialitis semipalmata*), knot (*Tringa canutus*), wandering tatler (*Heteractitis incanus*), yellow legs (*Totanus flavipes*), also several species of ducks and geese (in migration).

It is the writer's opinion that there are 25,000 land birds in the peninsula.

The islands are principally on the Pacific side and there parallel with the coast, extending from the mainland only a few miles seaward at most. They number something like 100 points, rocks, pillars and islands proper. By position, they naturally divide themselves into three groups. These groups were each made a bird reserve by President Theodore Roosevelt and designated as follows: Copalis Rock Reserve, near Granville (Tahola), thirty miles north of Grays Harbor; the Quillayute Needles Reserve, in the vicinity of LaPush, Washington, and the Flattery Rock Reserve, including all the rocks and islands from the Ozette Indian village to the entrance of the Strait of Fuca.

These islands fairly swarm with birds. The species most commonly observed are: western gull (*Larus occidentalis*), glaucus-winged gull (*L. glaucescens*), Heerman gull (*L. Heermani*), marbled murrlet (*Brachyramphus marmoratus*),[2] California murre (*Uria troile californica*), black oyster catcher (*Hæmatopus bachmani*), loon (*Gavia imber*),[2] white-winged scoter (*Oidemia deglandi*),[2] tufted puffin (*Lunda cirrhata*), pigeon guillemot (*Cepphus columba*), dark-bodied shearwater (*Puffinus griseus*),[2] surf scoter (*Oidemia perspicillata*),[2] Cassin auklet (*Ptychoramphus aleuticus*), rhinoceros auklet (*Cerorhinca monocerata*), American scoter (*Oidemia americana*),[2]

[2] Migratory.

Keading petrel (*Oceanodroma kædingi*), Brandt cormorant (*Phalacrocorax penicillatus*), white-crested cormorant (*P. dilophus cinninatus*), Baird cormorant (*P. pelagicus resplendens*), western grebe (*Æchmophorus occidentalis*),[2] Holboell grebe (*Colymbus holboellii*).[2]

It has been estimated that the birds of the island groups, including the migratory birds, number at least 100,000.

One hundred and thirty-seven species of birds have been listed from the Olympic Peninsula, and are described in the paper of which this is an abstract.

The full paper will probably appear in the *Transactions of the Kansas Academy of Science.*

The Differentiation of Neuroblasts in Artificial Culture Media: M. L. SHOREY, Milwaukee-Downer College.

The experiments to be described were conducted for the purpose of gaining evidence regarding the factors involved in the differentiation of neuroblasts. Previous experimental work has led to the expression of two radically opposed views; one that they are entirely self-differentiating (Harrison, 1907, Braus, 1906), the other that no differentiation occurs except in the presence of the normal end-organs, or the products of the metabolism of these organs (Shorey, 1909).

Neuroblasts from the medullary canal of *Necturus* were placed in artificial culture media, one containing the products of muscular metabolism, and the other not. In each the cells remained alive for a considerable period of time, but only in the first were fibers developed.

Spermatogenesis in the Mole Crickets: W. J. BAUMGARTNER, University of Kansas.

The paper will show the method of formation of the tetrads, and the method of maturation division. The work indicates that while Vom Rath is correct in theory, his figures are not at all true to the conditions found in the specimens. His illustrations must have been drawn mostly from imagination.

The chromosomes in the maturation divisions show a constancy of number, and a constancy of the series of shapes through which the individuals pass. The accessory is present, and one of the tetrads divides unequally.

This paper will be printed in Kansas University Science Bulletin.

H. V. NEAL,
GALESBURG, ILL. *Secretary*

[2] Migratory.

SOCIETIES AND ACADEMIES

THE TORREY BOTANICAL CLUB

THE first meeting of the club for 1911 was held at the American Museum of Natural History, on January 10, President Rusby in the chair. Dr. C. A. Darling, of the department of botany, Columbia University, was nominated for membership.

This being the annual meeting, reports were presented by the various officers.

The report of the treasurer was presented and upon motion referred to an auditing committee.

The secretary reported that fifteen meetings had been held during the year with a total attendance of 467, as against 411 in 1909, and an average attendance of thirty-one, as against twenty-seven last year. Twelve persons have been elected to membership, and eight resignations received and accepted. Six illustrated lectures were delivered during the season at which the combined attendance was 319, as against 251 at seven meetings last year.

The editor reported that the *Bulletin* for the year 1910 contains 630 pages and 36 plates, and that the expense of its publication was less than the amount allowed for it by the budget committee. He also reported that only one paper had been published in the *Memoirs*, this being a paper by Dr. O. Butler on "The Californian Vine Disease." The editor declined to be considered for reelection.

The editor of *Torreya* presented a special report for that periodical. The volume of *Torreya* for 1910 contained 292 pages.

The chairman of the field committee reported that twenty-three meetings were advertised during the year, one of which was an afternoon lecture at the New York Botanical Garden. Eight meetings were not held on account of stormy weather or from other causes. At the fourteen field meetings actually held there was a total of 103 persons present, making an average attendance of a little more than 7 at each meeting.

As chairman of the local flora committee, Dr. N. L. Britton gave a brief report of the investigations being carried on by Mr. Norman Taylor on the local flora.

Election of officers for the year 1911 resulted as follows:

President—H. H. Rusby.

Vice-presidents—Edward S. Burgess and John Hendley Barnhart.

Secretary and Treasurer—Bernard O. Dodge.

Editor—Philip Dowell.

Associate Editors—John Hendley Barnhart, Jean Broadhurst, Ernest Dunbar Clark, Alexander William Evans, Tracy Elliot Hazen, Marshall Avery Howe, Herbert Maule Richards and Norman Taylor.

The following committees were appointed by the president for the year 1911:

Finance Committee—John I. Kane and H. M. Richards.

Program Committee—Elizabeth G. Britton, Fred J. Seaver, Tracy E. Hazen and Jean Broadhurst.

Field Committee—E. B. Southwick, Norman Taylor and William Mansfield.

Committee on Local Flora—N. L. Britton, chairman, Phanerogams: N. L. Britton, C. C. Curtis, E. P. Bicknell, K. K. Mackenzie, E. S. Burgess and E. L. Morris. Cryptogams: Wm. A. Murrill, E. G. Britton, Tracy E. Hazen, M. A. Howe and Philip Dowell.

Budget Committee—H. H. Rusby, E. S. Burgess, J. H. Barnhart, B. O. Dodge, Philip Dowell and N. L. Britton.

Percy Wilson,
Secretary

THE ANTHROPOLOGICAL SOCIETY OF WASHINGTON

The 450th regular meeting of the society was held in the hall of the Public Library, December 20, 1910, 8 P.M., with the president, Dr. J. Walter Fewkes, in the chair.

The paper of the evening was on "The Winnebago Winter Feast," by Mr. Paul Radin. The speaker gave a description of the ceremonies incident to this feast and dwelt on the religious and social elements connected with the celebration.

In the discussion, which followed the reading of the paper, Dr. Swanton stated that among the Indians of the Pacific coast the ceremony is observed on the death of an uncle and to strengthen a chief, but in either case the social element predominates over the religious. Mr. La Flesche pointed out that among the old tribes the feasts are held about spring time, when life is awakened, heralded by the arrival of thunder. Mr. Hewitt and Dr. Fewkes gave parallels from the Iroquois and the Hopi Indians, respectively.

The 451st regular meeting of the society was held in the hall of the Public Library, January 17, 1911, with the president, Dr. J. Walter Fewkes, in the chair.

The first paper of the evening was on "The Totemic Complex," by Dr. A. A. Goldenweiser. The speaker first gave a brief survey of the study of totemism from the sixteenth century to the present as represented by Frazer, Morgan, Lang, etc., in England, and by Boas and Swanton in America. He then pointed out the difference of conception and method between the British and American investigators and subjected the English point of view to a thoroughgoing criticism. This point of view is evolutionary and comparative. It assumes totemism as a necessary stage in the evolution of religion and hence wherever it could trace the existence of one of the supposed elements of totemism, such as exogamy, tabu or totemic names, it established there the existence of the totemic system. In this way totemism was attributed to the ancient Egyptians, the Romans, the Semites (by Robertson Smith). Dr. Goldenweiser pointed out that the various features of totemism, such as exogamy, tabu and descent from an animal are nowhere found united, but exist separately and independently from one another and are hence not correlated to one another. Totemism can, therefore, not be studied as an organic whole, but in its various elements. The element of descent is the main feature which gives a social coherence and stability to a social group. Next to this in importance is the bond of union formed by common ceremonies.

The second paper was on "The Medicine Arrows of the Cheyenne," by Dr. Truman Michelson. The ceremony, which was attended by the speaker in 1908, consists of a long ritual, songs and prayers, and lasts through seven days. Of these the first three days are preliminary. The persons taking part in the ceremony are the chief priest, the candidate or candidates who are to be initiated, each accompanied by a friend who acts the "old man." The participants live during the seven days in lodges or tents within a closed precinct. The speaker recited parts of the songs and prayers addressed to sky and earth. These are accompanied by processions, moving from lodge to lodge, burning of pieces of sweet grass, etc. The center of the ceremony, which gives it its name, consists in laying arrows on the ground, with heads to north, surrounded by twelve buffalo heads. The officiating priest goes through various motions, while the candidate breathes four times on the arrows. No woman may witness the ceremony.

Both papers were discussed by Messrs. Swanton, Hewitt, Hough, Fewkes and Casanowicz.

I. M. Casanowicz,
Secretary